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[OFFICIAL NOTICE.]

First Annual Meeting, American Gas Institute.

NEW ALBANY, IND., Aug. 8, 1906.

The first annual meeting of the American Gas Institute, composed of the merger of the American, the Ohio and the Western Gas Associations, will be held in the Auditorium Hotel, Chicago, Oct. 17th, 18th and 19th, 1906, and will be called to order by Mr. B. W. Perkins, President of the Ohio Gas Association, who has been selected as presiding officer. The usual rates on certificate plan of 1½ fare are being arranged for. Due notice of the program and matters pertaining to the meeting of the Institute, will be given in subsequent issues of the JOURNAL, and through the mails.

Yours truly, JAMES W. DUNBAR,
Acting Secretary.

[OFFICIAL NOTICE.]

Wrinkle Department, American Gas Institute.

As former editors of the Wrinkle Department of the Western Gas Association and the Ohio Gas Light Association we are requested to collect a budget of wrinkles for presentation at the first meeting of the American Gas Institute, which will be held in Chicago, Ills., October 16th, 17th and 18th, 1906.

Drawings, photographs, sketches and description of any device, formulæ, or methods for accomplishing objects pertaining to the gas business, are respectfully solicited.

Thanking you in advance for contributing promptly. Yours truly,

W. E. STEINWEDELL, 719 Citizens Building, Cleveland, O.

B. MCADAM, Milwaukee Gas Light Co., Milwaukee, Wis.

[OFFICIAL NOTICE.]

Fourteenth Annual Meeting, Pacific Coast Gas Association.

PROGRAMME.

Officers 1095-06.—John Martin, President; C. O. G. Miller, Vice-President; John A. Britton, Secretary and Treasurer.

Directors.—C. R. Collins, Seattle, Wash.; R. H. Sterling, Watsonville, Cal.; W. F. Boardman, San Francisco, Cal.; Herbert C. Brown, Los Angeles, Cal.

Editors.—Geo. S. Colquhoun, Wrinkles; R. P. Valentine, Experiences; Geo. H. Hollidge, Novelties; Geo. P. Low, Historian.

Librarian.—E. C. Jones.

COMMITTEES.

Committee on Gas Engineers' Degree.—L. P. Lowe, E. C. Jones, John A. Britton.

Committee on Permanent Home.—L. P. Lowe, C. O. G. Miller, Henry C. Keyes.

Advisory Board.—E. C. Jones, C. O. G. Miller, John A. Britton.

Morning Session, 10 A.M. to 12:30 P.M. Afternoon Session, 1:30 P.M. to 5 P.M.

Order of Business, September 18th, 1906.—1. Roll Call. 2. Reading minutes last session. 3. Communications. 4. Report of Secretary and Treasurer. 5. Report of Directors 6. Report of Special Committees. 7. Report of Library Committee. 8. Balloting on applications for membership. 9. Appointment of Committees. 10. Miscellaneous Business.

After above order of business papers will be read as per list following, but not necessarily in the order in which they are printed.

List of Papers to be Read.

President's Address.
"Should Gas Companies Engage in the Sale of Gas Appliances," W. B. Cline.
"Best Method of Promoting Gas Sales," S. P. Hamilton.
"Experiments with Lampblack in Water Gas Generators," Geo. S. Colquhoun.
"How the San Francisco Gas and Electric Company Supplied 40,000 Consumers After the Fire," S. L. Naphtaly.
"How Electricity was Served to Consumers and Street Car Lines, by the San Francisco Gas and Electric Company After the Fire," L. E. Reynolds.
"Personal Experiences with Municipal Gas Plant," D. O. Druffel.
"The Equity of Sliding Scale Gas Rate," E. C. Jones.
"Experiences with High Pressure Gas Mains," Sherwood Broker.
"Utilization of Gas Engines for Power Purposes," E. C. Lufkin.
"Subject to be Announced," James Goodwin.
"Some Practical Data on High Pressure Gas Compression and Transmission," E. A. Rix.
"The Art of Canvassing," John Clements.
"Novelty," Editor G. H. Hollidge.
"Wrinkle," Editor Geo. S. Colquhoun.

LIBRARY OF CONGRESS

"Experience," Editor R. P. Valentine.
"Historian," Geo. P. Low.
"The Gas Institute," F. H. Shelton.

Upon completion of reading of papers, the following will be the order of business: 1. Report of Committees. 2. Election of Officers. 3. Unfinished Business. 4. New Business.

Wednesday, September 19th, Banquet. Thursday, September 20th, Outing.

JOHN A. BRITTON, Secretary.

BRIEFLY TOLD.

THE NATURAL GAS ASSOCIATION.—In our columns appears in this issue of the JOURNAL the report of the proceedings of the first annual meeting of the Natural Gas Association held in Kansas City, June 12 and 13, 1906. This marks a departure in the relations that have existed between the manufactured and natural gas interests. In recent years both electrical and natural gas companies have found it to their advantage, and to the advantage of the manufactured gas companies to work hand in hand with them, as is seen by the many combinations that have taken place of these apparently opposing interests. The uncertainty of a natural gas supply makes the possession of a manufactured supply, and right to supply, almost necessary. The use of manufactured gas mains for supplying gas, saves a large initial expense and ruinous opposition is avoided. On account of the strong feeling against natural, gas it took the manufactured gas men a long time to realize the inroads being made by what has become a giant industry, even the consumers were loath to see the advantages of a cheaper fuel, but the annihilation of some gas companies and the partial wrecking of others has opened the eyes of us old line people, and like the poor it looks as if this "natural" friend would be "always with us." There is no question as to the outcome of fights between well equipped natural gas companies and manufactured companies. No better gas town is to be found than that which has had natural gas at one time, and if we are able to stick, we will come to our own again. It gives us great satisfaction to see the head of this Natural Gas Association movement, Mr. K. M. Mitchell, in our own ranks, and it is fair to assume that as our associations have improved our industry, the Natural Gas Association will do a great deal towards compiling data, and working out the problem of location of gas wells, and not "dusters," etc. Much credit is to be given the natural gas men for their successful working out of the high pressure distribution system, the pumping of gas and the improvement in pipe lines for long distance transmission. It is to the natural gas man we owe the formulæ for high pressure gas deliveries over long or short lines. He may have borrowed of us, but he has also given in return.

NOTES.—

THE Fleming-Wilson natural gas franchise at Kansas City, Mo., has passed the Council and has been signed by the Mayor. The grantees have 20 days to qualify by giving a $50,000 bond for the fulfilment of the terms of the franchise. On September 18 they will have to furnish another bond of $100,000. The cost of the plant is estimated at $7,000,000.

THE Clarksburg (W. Va.) Light and Heating Company has reduced the price of gas from 10 to 5 cents per 1,000 feet. The action was caused by the entrance of the Hutton Gas Company in the city.

A 10-INCH main is being laid to supply Hutchinson, Kas., with natural gas from Wichita.

WORK on the extension of the Mohican Oil and Gas Company's mains into Akron, O., has been commenced in earnest, and H. A. Fritz, General Manager of the Company, says that the extension will be completed by September 1.

THE fight which the Natural Gas Company, of West Virginia, is making to secure council's consent to alter its franchise at Columbiana, O., to the extent of permitting the use of natural gas for lighting purposes, as well as for heat and fuel, as at present, is progressing merrily, with developments up to date materially favoring the gas company. The opposition is based on a fear that the introduction of gas for lighting will prove destructive competition for the municipal electric plant.

FOLLOWING the line of improvement in the gas supply throughout the city of Meadville, Pa., the Oil City Fuel Supply Company is laying a 6-inch high pressure line which enters the city at the eastern limits, to its gasometer situated on North street. When this line is completed the Company will shut off the pressure supply from its other high pressure line which enters the city from the south.

A MEETING was held in the Keystone bank building, Pittsburgh, Pa., at which the holdings of the Borchers Gas Company were transferred to the Franklin and Washington (Pa.) Gas Company for the consideration of $60,000. The latter Company is capitalized at $75,000, and in the transfer the new Company gets five good producing oil wells located in South Franklin field, 4,000 acres of valuable gas territory, the plant of the Borchers Company, and the franchise in West Washington, including all the lines that have been laid in that borough.

[OFFICIAL REPORT—REVISED BY THE SECRETARY—CONTINUED FROM PAGE 324.]

THE TWENTY-NINTH ANNUAL MEETING, WESTERN GAS ASSOCIATION.

HELD IN CLEVELAND, O., MAY, 16, 17 AND 18, 1906.

THIRD DAY—MORNING SESSION.

The President—Now the Question Box. We have had submitted one or two questions. We don't want to trespass on the territory of our brother-in-law the Ohio Association Question Box. Mr. Gribbell, you have a question. Will you answer it, please?

QUESTION BOX.

Mr. Gribbel—Mr. Chairman, I had handed to me a moment ago this question:

> "What is the effect of coke oven gas upon meter diaphragms and what is the proper oil to be used in the diaphragms of meters that are used for measuring coke oven gas?"

The period of observation has not been long, but the indications up to date are that it is a question simply of purification, scrubbing and condensing. The coke oven gas is no harder on the diaphragm than the average coal gas that is made from that same coal. Remove your ammonia, and you will not have any serious difficulty, given also proper condensation. As regards the proper oil filler to use in these diaphragms, I would say that the same filler that you would use in the diaphragm for the average coal gas will fit this gas also.

The President—There was one other question, which was handed to Mr. Baehr. Mr. Baehr is not present, but he will have to make good on the question. Are there any further questions for the Question Box? If not, the next order of business is the

ELECTION OF OFFICERS.

Nominations for President are in order.

Mr. E. G. Pratt—Mr. President, I desire to place in nomination Mr. K. M. Mitchell.

The President—Mr. Mitchell is nominated, gentlemen. Are there any other nominations? If there are no other nominations, I think I may take it that you instruct your Secretary to cast the unanimous ballot of the Association for Mr. K. M. Mitchell for President. Hearing no objections, I will ask Mr. Dunbar to do so.

The Secretary—Mr. President, in accordance with your instructions I cast the unanimous vote of the members present for Mr. K. M. Mitchell to serve as President for the remaining year.

The President—It is so ordered. Mr. Mitchell is your President. First Vice-President?

Mr. T. D. Miller—I nominate Mr. Baehr.

The President—Mr. Baehr is nominated. Are there any other nominations? If there are no other nominations, I will declare nominations closed. Hearing no objections, I assume it is the unanimous desire of the members to have the Secretary cast the ballot of the Association for Mr. Baehr for First Vice-President.

The Secretary—Mr President and Members, I cast the unanimous vote of the members present for Mr. Baehr to serve as First Vice-President for the ensuing year.

The President—It is so ordered. Mr. Baehr is the First Vice-President. Second Vice-President?

Mr. McLean—A former Iowa man has anticipated me slightly, perhaps.

The President—Iowa is expansive.

Mr. McLean—It is indeed. Of all that is good, Iowa affords the best. I take pleasure in nominating for Second Vice-President Mr. L. L. Kellogg, of Iowa.

Mr. E. G. Pratt—I was about to make the same nomination, but I have pleasure in seconding it.

The President—It is quite evident that Mr. Kellogg is the unanimous choice of the Association for Second Vice President. Are there any other nominations? If not, I will declare the nominations closed. I assume it is the expressed wish of the Association that the Secretary cast the unanimous ballot of the Association for Mr. L. L. Kellogg as Second Vice-President.

The Secretary—Mr. President, I cast the unanimous vote of the members present for Mr. L. L. Kellogg to serve as Second Vice-President for the ensuing year.

The President—Is Mr. Kellogg in the room?

A Member—He is not here.

Mr. Roper—Mr. Kellogg just left.

The President—Has he gone?

Mr. Roper—He may be downstairs getting ready to go.

The President—Mr. Baehr is not in the room. We cannot have any responses, unfortunately, from the men whom we have chosen to honor. Nominations for Secretary and Treasurer are in order.

Mr. Ramsdell—I nominate Mr. Dunbar.

The President—I assume there are no other nominations. It is my pleasure, therefore, to cast the unanimous ballot of the Association for Mr. James W. Dunbar for Secretary and Treasurer for another year. I do so with a great deal of pleasure. Mr. Dunbar, you are declared elected Secretary and Treasurer. (Applause.) Nominations for Directors are in order. Four Directors are required under the constitution. The retiring Directors are Walton Clark, Daniel R. Warmington, Edwin E. Witherby and William E. Steinwedell. If you will nominate four gentlemen they can be balloted upon at once.

Mr. T. D. Miller—Mr. President, I place in nomination the four gentlemen who are retiring as Directors at the present term. I place them in nomination for re-election. (Seconded.)

The President—If there are no other nominations, you have heard the motion, that the gentlemen who retire this year, whose names I have just read, Walton Clark, Daniel R. Warmington, Edwin E. Witherby, William E. Steinwedell, be declared elected Ditectors for the ensuing year. Are there any other nominations? Hearing no other nominations, I will ask the Secretary to cast the unanimous ballot of the Association for the gentlemen whose names have been read.

The Secretary—Mr. President, I cast the unanimous vote of the members of the Western Gas Association present for Messrs. Walton Clark, Daniel R. Warmington, Edwin E. Witherby and William E. Steinwedell, to serve as Directors for 2 years.

The President—It is a vote, and these gentlemen are declared Directors. The Editor of the Wrinkle Department.

The Secretary—I nominate Mr. McAdam.

The President—Hearing no other nominations, I assume it is the unanimous desire of the Association to have Mr. McAdam remain as the Editor of the Wrinkle Department for the coming year, and I so declare it as a vote. The next order of business is

Miscellaneous Business.

Mr. Elbert—Mr. President, I wanted to ask a question, whether the published proceedings were gone over yesterday?

The President—That has come up, and there has been a committee appointed to publish the proceedings.

Mr. Elbert—I would ask further: Is there a prospect of having all the proceedings of this Association that are on record published?

The President—That is to be considered by the committee.

Mr. Leonard Fitzgerald—I would like to find out if we could have the reports that were made on the formation of the Gas Institute and the proposed constitution published and distributed in pamphlet form to the members of the Association, so that we would have some clear idea of what we are going into. The report was read before the American Association and, I believe, should be distributed to the members of the Western in pamphlet form.

The President—That can be referred to the Committee on Organization. Is there any further business? If not, we pass to the

Report of the Committee on Final Resolutions,

of which Mr. James W. Dunbar is the Chairman.

The Secretary—Mr. President and Members of the Western Gas Association: How often in this transitory life are we brought to a realization of the fact that the best of friends must part, and that on the morrow ties which have bound will no longer cement us as a Brotherhood, which has been characteristic of membership in the Western Gas Association. Changed conditions decree that we no longer as an Association continue our organization, however successfully we might be able to do so. That it is able to cope with problems, overcome difficulties, and find new avenues for the successful exploitation of the industry is evidenced by the personnel of its membership, and the successful meeting about to be closed, which will always redound to the glory of its President, Mr. Paul Doty. During its organization papers have been presented that have been an inspiration and spurred its members and the industry into successful endeavors that we feel safe in asserting have advanced our march many years on the road of progress. In this, our last annual gathering, the Committee on Final Resolutions offers the following as suitable for the occasion:

Whereas, the Western Gas Association, after an existence of 29 years of useful service to the industry for the promotion of which it was organized, recognizing the tendency of the times and the more effective work to be accomplished by united efforts obtained by the merger of the large Associations into an organization to be known as the American Gas Institute, now finds its existence as a distinct organization to be at an end. We offer the following resolutions:

Resolved, We will remember with grateful appreciation and love, friendships enjoyed: recognizing that a distinctive feature of the Western Gas Association membership has been good fellowship and kindness of its members one to another. The hand of friendship has been extended to receive the warm, magnanimous grasp of him to whom it was offered. Friendships have been formed which will always be cherished, valued and retained as one of the sweetest relations in life. And be it further

Resolved, We, recognizing all societies and organizations are dependent largely upon the personality of some one who has impressed upon its members that which is a part of himself, accord to our oldest Past-President, Uncle Jerry Howard, whom we all love, and who had the honor of twice serving as President during the formulative period of the Western Gas Association's history, that by his most attractive personality, his warm and generous impulses, he drew friends to himself and the Association, who delighted in his companionship and deemed membership in the Association a privilege in every way beneficial. We are sure we voice the sentiments of every member of this Association when we express our love and wish him and his many years of joy, health and contentment.

The Western Gas Association's usefulness was not ended. It could have continued to do the work for which it was organized, and to do it effectively, but this is an age of consolidation and concentration of energy and ability. We bow to the inevitable, but will ever cherish the memory of the Western Gas Association.

Mr. T. D. Miller—I move the adoption of the resolutions. (Adopted.)

The Secretary—Mr. President, I move that the thanks of the members of the Western Gas Association be extended to the local Committee of Arrangements, who have carried out their work so effectively and with so much evidence of forethought and of care and desire for our entertainment. I move that they be most heartily thanked, and that the Secretary be instructed to send them expressions of our appreciation. (Adopted.)

Mr. E. G. Pratt—Mr. President, if in order at this time I would like to offer this resolution: That the unanimous thanks of the Association be given to the retiring officers. I want to say just one word in respect to that motion. It seems to me that no programme in the history of this Association or in the history of any gas association in recent years has been carried out more directly or with a better idea of smoothness and order than has the programme which has been prepared for this meeting now about closing. In spite of the fact that the weather has been very oppressive and very uncomfortable, the officers have stuck to their posts, and the programme has been carried out without any material change. I feel that in view of the work incident to a meeting of this kind, and I know something of what it means, the unanimous thanks of the Association should be given to the retiring officers.

(The motion was seconded. It was put by Mr. Pratt, and was adopted unanimously by rising vote.)

Mr. Pratt—Mr. President, you and your associates have the nnanimous thanks of the Association.

The President—I am sure that I speak for the officers of the Association when I say that we are deeply indebted to you for your co-operation. Without your co operation we could have done but little. You have heard the statement of Andrew Carnegie, I believe, that he wished to have inscribed on his monument, "Here lies a man who knew how to surround himself with men more able than himself," and that is substantially the position in which your President has been during this meeting. I have been surrounded with men who have been thoroughly imbued with the spirit of the Western, the spirit of loyalty and co-operation and high intelligence. The time has now come for final adjournment. Is there any further business before I declare the meeting adjourned *sine die*? The meeting is now beclared adjourned *sine die*.

ROLL CALL.

Honorary.

J. B. Howard, Galena, Ills.

Active.

Baehr, W. A., St. Louis, Mo.
Barret, A. H., Louisville, Ky.
Barthold, W. H., Saginaw, Mich.
Beardslee, C. S., Cleveland, O.
Bixby, H., Green Bay, Wis.
Blinks, W. M., Kalamazoo, Mich.
Blowers, F.W., Kalamazoo, Mich.
Bradley, C. W., Chicago, Ills.
Bredel, F., Milwaukee, Wis.
Brown, E. C., New York City.
Burgess, C. F., Madison, Wis.
Chamberlain, G. R , Grand Rapids, Mich.
Chollar, B. E , Kansas City, Mo.
Christie, W. H., Corning, N. Y.
Chubb, C. N., Sioux Falls, S. D.
Clarke, G. S., Kansas City, Mo.
Clark, J. C. D., St. Louis, Mo.
Clapp, G. N., Middletown, O.
Clary, E. D., Burlington, Ia.
Collins, C., Elkhart, Ind.
Colvin, J. E., Muncie, Ind.

Cowdery, E. G., St. Louis, Mo.
Cressler, A. D., Fort Wayne, Ind.
Crowell, F. B., Atlanta, Ga.
Dell, J., St. Louis, Mo.
Dickey, C. H., Baltimore, Md.
Dixon, J. A., New York City.
Doty, P., St. Paul, Minn.
Duffield, J. C., London, Ont.
Dunbar, J. W., New Albany, Ind.
Earnshaw, E. H., Cincinnati, O.
Egner, F., Norfolk, Va.
Elbert, V L., St. Paul, Minn.
Eustace, E. W., Peoria, Ills.
Eustace, J. H., Chicago, Ills.
Eysenbach, E.E., Binghamton, N.Y.
Finnegan, A., St. Louis, Mo.
Fisher, D. G., St. Louis, Mo.
Fitzgerald L., Waukegan, Ills.
Forstall, A. E., New York City.
Freese, F. W., Fort Wayne, Ind.
Gimper, J., Galveston, Tex.
Goodnow, G. F., Waukegan, Ills.
Greenough, M. S., Cleveland, O.
Gribbel, J., Philadelphia, Pa.
Haines, J., Des Moines, Ia.
Hartman, W. E., Joliet, Ills.
Holman, C. L., St. Louis, Mo.
Hyde, G. A., Cleveland, O.
Jones, T. C., Delaware, O.
Kelley, F. W., Davenport, Ia.
Kellogg, L. L., Sioux City, Ia.
Kincaid, H. E., Jackson, Tenn.
Knapp, I. N., Ardmore, Pa.
Knight, C. S., Fort Wayne, Ind.
Lane R. M., Chicago, Ills.
Lynn, J. T., Detroit, Mich.
Macbeth, A. B., Kansas City, Mo.
Mansur, J. H., Royersford, Pa.
Mayers, J. A., New York City.
McAdam, B., Milwaukee, Wis.
McDonald, W., Albany, N. Y.
McIlhenny, J. D., Philadelphia, Pa.
McLean, G., Dubuque, Ia.
Miller, R. S., Muncie, Ind.
Miller, T. D., New Orleans, La.
Miller, W. B., Birmingham, Ala.
Mitchell, K. M., St. Joseph, Mo.
Morrell, E E., Oak Park, Ills.
Moses, F. D., Trenton, N. J.
Norris, R., Philadelphia, Pa.
Olds, H. L., Lincoln, Ills.
O'Malley, P., Aurora, Ills.
Pratt, E. G., Milwaukee, Wis.
Pullen, J. T., Jackson, Miss.
Purcell, T. V., Chicago, Ills.
Quinn, A. K., Newport, R. I.
Ramsdell, G. G., New York City.
Rice, H. L., Aurora, Ills.
Roper, G. D., Rockford, Ills.
Schwarm, C. A., Joplin, Mo.
Shelton, F. H., Philadelphia, Pa.
Steinwedell, W. Quincy, Ills.
Steinwedell, W. E., Cleveland, O.
Stiles, H. B., St. Paul, Minn.
Strain, G. A., Flushing, N. Y.
Strohn, C. B., Aurora, Ills.
Von Maur, J. D., St. Louis, Mo.
Wakeman, A. E., Glens Falls, N.Y.
Wallace, W., Lafayette, Ind.
Waring, G. H., Omaha, Neb.
Warmington, D. R., Cleveland, O.
Warmington, G. H., Cleveland, O.
Whitton, W. H., St. Louis, Mo.
Whysall, G., Columbus, O.
Wilkinson, A. L., Detroit, Mich.
Williamson, J., Chicago, Ills.
Witherby, E. E., New York City.
Woods, G. E , New York City.
Young, R., Sheboygan, Mich.

Associate.

Asendorf, C., Chicago, Ills.
Barnes, G. W., Pittsburgh, Pa.
Bigelow, L. S., New York City.
Brill, A. P., Pittsburgh, Pa.
Brownell, E. E., Chicago, Ills.
Buckley, J. C., Chicago, Ills.
Carpenter, H. A., Pittsburgh, Pa.
Carter, T. B., St. Louis, Mo.
Collins, D. J., Philadelphia, Pa.
Corbus, F. G., Philadelphia, Pa.
Dean, M., New York City.
Dickey, E. S., Baltimore, Md.
Eaton, A. B., Chicago, Ills.
Elliott, H. J., Chicago, Ills.
Guldlin, O. N., Fort Wayne, Ind.
Harper, H. D., Chicago, Ills.
Hayward, S. F., New York City.
Hicks, G. C., Jr., Connersville, Ind.
Kahn, L., Hamilton, O.
Kellum, B. J., Chicago, Ills.
Leakey, N. G., Detroit, Mich.
Lindsay, C. R., Jr., Chicago, Ills.
Lovett, E. C., Oak Park, Ills.
McDonald, D., Albany, N. Y.
Miller, F. A., Bradford, Pa.
Morava, W., Chicago, Ills.
Mueller, H., Decatur, Ills.
Osborn, H. H., Chicago, Ills.
Persons, F. R., Toledo, O.
Plantinga, P., Cleveland, O.
Polk, R. W., St. Louis, Mo.
Printz, C. H., Fort Wayne, Ind.
Reynolds, M. G., Anderson, Ind.
Russell, D. R., St. Louis, Mo.
Seeger, R., St. Louis, Mo.
Sierra, J. C., Milwaukee, Wis.
Stacey, A. J., Cincinnati, O.
Stadelman, W. A., New York City.
Stephens, J. G., Pittsburgh, Pa.
Strain, J. R., Chicago, Ills.
Stratton, S. S., Chicago, Ills.
Van Wie, E. G., Detroit, Mich.
Wickham, L., St. Louis, Mo.
Witherden, G. M., Philadelphia, Pa.
Zitzewitz, H., Chicago, Ills.

FIRST ANNUAL MEETING OF THE NATURAL GAS ASSOCIATION OF AMERICA.

HELD IN THE ASSEMBLY HALL OF THE MIDLAND HOTEL, KANSAS CITY, MO., JUNE 12 AND 13, 1906.

FIRST DAY—MORNING SESSION.

In opening the meeting, the President remarked briefly as follows:

"Gentlemen of the Association, I am glad to meet so many of you here this morning. In looking over this meeting I was just thinking that we had almost as many in attendance as we had at the meeting of the Western Gas Association which was held at Cleveland, O., last month; and I am heartily glad to see so many of you here this morning.

"I think we shall start right in now, the first order of business being Roll Call by the Secretary, Mr. J. H. Dunkel, of Lawrence, Kas."

After the Roll Call, the reading of the minutes held March 20, 1906, and the presenting of applications for membership and balloting, there being no reports of committees, the President delivered the following address which was ordered spread on the minutes of the meeting.

PRESIDENT'S ADDRESS.

It became apparent to the vendors of natural gas that there was something needed to conserve the interests of natural gas men, so it was proposed to the various managers of natural gas companies in Kansas and Missouri that an association of natural gas men be organized. Accordingly, a meeting for this purpose was held in the Midland Hotel on February 20th, 1906, and an organization was immediately effected. The name chosen for the organization was the "Natural Gas Association of America," and it was proposed to cover the natural gas interests of both the United States and of Canada. The object of the association is to promote the increased sales of gas and to promulgate the ways, means and methods necessary thereto.

As President of this Association, I am anxious that its interests shall not suffer from my inability to guide its affairs. We must be alert and raise the standard of our Association to the highest level, and the accomplishment of this object depends not on the efforts of the president alone, but upon the co-operation of each and every member of the Association. Our calling is one of the greatest importance to the public. We serve the people's needs in domestic and commercial supplies of the ideal fuel; we are their servants; we direct and harness the fuel (which the Almighty has so abundantly provided), safely into the various appliances in the homes of our patrons; and our training must be to develop the greatest economy in its combustion both for light and heat so as to obtain the greatest revenue possible in competition with other methods. We know that it is not an easy matter to burn large volumes of gas in a furnace or stove successfully, we must have a knowledge of the laws of combustion and of chimney drafts, and be able to determine the best installation in each individual case. We are expected to attend to the administrative duties, and to be on good terms with the legislative portion of our community. We must be able to trade and barter and to advertise the goods we sell. While we have a monopoly of this valuable commodity, we must be as considerate of the public as if we had the greatest competition. We must bring our gas to the attention of all classes, pointing out the many conveniences and comforts derived from its use. I believe we should guard this great gift which comes to us spontaneously, free from all impurities, and of the highest calorific value of all known gases, with the greatest care, and that its application should be confined strictly to domestic uses. I believe by its judicious application and husbanding, we will have an overlasting supply of this greatest of all fuels.

In the distribution of this gas as it comes to us under high pressure, we must so reduce the pressure to the consumer that he will have an absolutely steady and uninterrupted flow at a comparatively low pressure under his absolute control. We should study the distribution system, and a judicious system of high pressure belt lines, or a center line of main through the heart of the distribution system should be provided; taking off the supply through governors from the high pressure lines to the distributing mains.

The adoption by the public of the Welsbach incandescent mantle burner has been phenomenal, and has permitted of the substitution in our mains of the natural gas for the artificial product in a day with no real inconvenience experienced, as has taken place recently in a number of comparatively large cities where artificial gas has been used. The adjustment of the Welsbach burner and the throttling of the gas in the gas range was all that was necessary in making the change from artificial to the natural gas.

I have written to the following gentlemen, suggesting that they furnish us with papers for discussion at this meeting as follows:

Mr. A. G. Holmes, Pittsburgh Meter Company, E. Pittsburgh, Pa.—"Proportional and Tin Gas Meters."

T. J. Little, Expert, Welsbach Company, Gloucester, N. J.—"Illuminating devices of the Welsbach Company."

Wm. M. Welch, Independence, Kas.—"The Economy of Gas Engines as against other Power."

Frank Stuchell, Pittsburgh, Pa.—"Variations and causes of Variation of Proportional Meters, and the simplest method of testing them."

E. S. Springer, Leavenworth, Kas.—"The Chronic Kicker and How to Handle Him."

C. L. Bullock, Joplin, Mo.—"The Best Method of Handling Industrial Consumers of Large Capacity."

Jno. L. Maloney, Leavenworth, Kas.—"Best Methods of Installing Low Pressure Boilers and Hot Air Furnaces to Get Best Results."

M. M. Sweetman, Kansas City, Mo.—"How to Maintain a Feeling of Mutual Interest Between Company and Consumer."

A technical paper on Natural Gas will be presented by Prof. E. Haworth, Kansas State Geologist.

Mr. George W. Earnes, of Pittsburgh, Pa., one of the foremost natural gas engineers of the United States, will be present to take part in any or all discussions, as well as to dispense information most valuable to members of the Association.

The subjects to be discussed at these meetings are of the utmost importance, and we want the members to feel perfectly free to make suggestions, which we will give earnest consideration and attention.

I am going to propose that we have a "Question Box," and that we have it now. Drop in your questions, signing your name to them, so that we may know they have been asked in good faith. We want every member to feel that he has a part to take here. We want your experience, and we will be glad to give you ours. I will not take up further time, but we will now proceed to the further business of the morning.

The President—The first paper to be read this morning will be that of Wm. W. Welch, of Independence, Kas., on "The Economy of the Gas Engine as Against Other Power"

Mr. Welch—Before starting on my paper, I should like to refer to what our President said in regard to getting the greatest revenue out of natural gas—the product which we are selling—and yet saving the supply so that it will extend over a long period of time, and with the result that the benefit is both to the gas company and to the gas consumer—the buyer of the fuel. Now, this has a direct bearing upon the subject of my paper this morning

THE ECONOMY OF THE GAS ENGINE AS AGAINST OTHER POWER.

At the present time and in this section of the country, with the use of natural gas just becoming general, the gas engine question is one of the most vital questions which presents itself to the gas man.

In the first place, the gas engine has just reached that point where we can say from experience that it is a success. For there are gas engines of all sizes which have proved beyond a question that they are satisfactory, satisfactory not only from the standpoint of the saving in fuel, but a saving in other respects also. There are engines in use to-day of sizes up to at least 1,000-horse power, which from the standpoint of maintenance and low cost of operation are eminently successful.

The thing which now remains to be done is for those interested to investigate for themselves the condition of the gas engine business to-day.

Of course there will continue to be improvements in design and construction, for a long time to come, and just as there is to-day and has been for many years past, improvement in the field of electric motors and even steam engines, but the idea which exists in the minds of some people that the gas engine is still in an experimental stage is very much mistaken one.

It is a wonderfully fortunate thing for us who are connected with the natural gas industry to-day that the gas engine has reached its present state of development and it is also a fortunate thing for those users of power who are so situated that they can take advantage of the opportunity presented.

Before going to the comparison of the efficiencies of the gas and the steam engine, which is the limited scope that I have given to this discussion, let me jump to a few conclusions along this line, and show you wherein the natural gas is an advantage to us as sellers of natural gas and also to the power user wherever the gas is within his reach.

It has been demonstrated that a power business is a necessity to a natural gas company doing a business of any magnitude.

With the power business to fall back upon, not only during the 6 summer months, but during the balance of the year or until the time comes when the domestic consumption on acconnt of extremely cold weather increases to such a point that the capacity of lines furnishing the supply has been reached, satisfactory business results during all seasons.

With steam power business, it must be borne in mind that the rate is on an average just two-fifths of the domestic rate and the only reason you are selling gas at this rate is to keep your plant operating and your investment making a return during such time as you are not able to dispose of the gas at a higher domestic rate.

This low power rate which is made, is a result of the necessity to compete successfully with a good grade of cheap coal. The power business, although it can be handled by the distributing company much cheaper than domestic business for the same amount of gas consumed, is not by any means as desirable as the domestic, if the domestic business rate can be secured. What I mantain and what I will endeavor to show you is this, that by diverting this power business from a steam engine business to a gas engine business, we will be able to secure from it the domestic rate for 12 months of the year, and although the seller of natural gas is getting a larger price for his gas to the extent of two and one-half times as much, the consumer of the gas or the power user is buying his power for just about one-half of the price he pays when he burns the gas under the boiler.

If the above statements which I have made are true, then it would seem that the matter would be one of vital interest to all concerned in natural gas, whether he be buying or selling gas for power or whether he be a domestic consumer, as any economy or saving in the use of gas will result in the longer use of it for domestic purposes, and a supply which might be ordinarily expected to last for 16 to 20 years, be prolonged for many more.

Before making the comparison I will briefly explain the difference between a boiler horse power unit and an engine horse power unit.

For either the steam or gas engine, the power unit is the same, that is, it is a measure of the rate or doing work and is called a horse power, equivalent to 550 foot pounds per second; 33,000 foot pounds per minute, or 1,980,000 foot pounds per hour. A horse power hour is the work done in overcoming a resistance for a period of 1 hour at the unit rate which is given above.

The power of an engine can be derived by several different means and it is a comparison of these means with which we are concerned at the present. The amount of energy required, however, to develop a horse power, differs depending upon the type of engine, etc.

The quadruple expansion steam engine will develop a horse power hour with a consumption of 10 or less pounds of steam, while a simple engine of a crude construction will require from 50 to 60 and sometimes more. A good gas engine will develop a horse power hour with a gas consumption varying from 9 to 15 cubic feet per hour. It is my intention to show you the relative economy of steam and gas engines when both are reduced to the same basis of the number of cubic feet of gas consumed.

A boiler horse power is the unit of the evaporative capacity of a boiler in a certain length of time, and does not represent the performance of so much work in the same sense as an engine horse power—34½ pounds of water at 212° F. evaporated into steam at the same temperature in 1 hour represents one boiler horse power unit; the same thing can be expressed in a different form by saying that 30 pounds of water raised from a temperature of 70° and evaporated into steam and the steam confined until its pressure had accumulated to 100 pounds, equals 1-horse power.

The point which I wish to make clear, is this—that if it takes 50 cubic feet of gas to develop a boiler horse power, and if you are using steam equivalent to 200 boiler horse power, it does not necessarily imply that you are getting 200-horse power of useful work from your engine and that you are expending 50 cubic feet of gas per horse power to do it. If your engine is consuming 34.5 pounds of steam, when reduced to a basis of "from and at 212," then the above will be true, but if your engine were using 38 pounds of steam instead of 34.5 then the horse power in your engine would be developed at an expense of 54 cubic feet of gas. If your engine were an economical one, and used only 25 pounds of steam, then the engine horse power would only be costing you 35 cubic feet. So, clearly get in mind that a steam engine horse power may be developed with a gas consumption which varies through a wide range, depending upon the type of engine.

The tests of the amount of gas consumed under a boiler to develop a boiler horse power give practically the same results when the proper conditions are existing at the boiler, and from the results of numerous tests it is safe to assume that under favorable conditions 50 feet of gas will be required. The conditions are sometimes very much worse, and but seldom any better.

Taking into consideration some of the most economical steam plants of from 250 to 1,000-horse power, where compound engines are used in connection with condensers, and other saving devices, it will be found that allowing for losses, due to steam piping, auxiliary pumps and other wastes, the steam consumption per indicated horse power will not fall short of 25 pounds, and 28 pounds for brake horse power. In such a case the gas consumption would be 40 cubic feet per brake horse power at the engine. In exceptional plants, this condition might be bettered to the extent of 10-horse power, or 15 per cent. and in the very large power plants, still better results are obtained, but these are isolated cases and need not be considered in comparisons made here.

If your engine were of the high speed simple automatic type, your steam consumption would be about 38 pounds, all losses being taken into consideration and the gas consumption per brake horse power 54 cubic feet, but if the engine were of the ordinary simple type, with possibly leaky valves, and piston rings, the steam consumption might be as high as 60 or 70 pounds. In this last case the gas consumption would be on a basis of 60 pounds of steam used, 85 cubic feet per horse power.

Our results then are with the three foregoing types of engines as follows: Compound engines under running conditions, 40 cubic feet of gas, automatic 54, plain slide valve 85.

It is with these figures that I will compare the performance of the gas engine and show the saving in fuel consumption.

But before going into the figures pertaining to the gas engine, I will show what the thermal efficiency is in the above case of the steam engine.

Taking first the case of the automatic engine where a horse power hour is developed with a gas consumption of 54 cubic feet, we will assume that the temperature of the gas is such that there is no correction for temperature required. The only correction therefore is for pressure. In this calculation it may be assumed that the pressure of the atmosphere is such as to give a barometer reading corresponding to 14.5 pounds. With gas measured at 8 ounces, the multipliers to get the actual number of cubic feet of gas consumed would be 1.035.

In 1 cubic foot of gas there are 996 heat units. Therefore to develop 1-horse power at the brake or belt of the engine there are required 53,784 B. T. U. The equivalent in work for 1 B. T. U. is 778 foot pounds, therefore the number of foot pounds represented in the above is 81,844,000.

The theoretical number of foot pounds in a horse power hour is 1,980,000 and the actual thermal efficiency is 4.7 per cent. This means that of the actual heating value in the gas that 4.7 of it is being made use of to drive the belt of your shafting or do other work. This may seem startling, but nevertheless the facts remain, the points where the losses occur being many, granting that the consumption of gas in your furnace is perfect, that is, that all of the available gases are combined, during combustion with the proper proportion of oxygen to form carbonic acid gas and that no carbon monoxide is formed, there will always be more or less excess of air to be heated. This air with the carbon dioxide resulting from combustion and the nitrogen in the air, are heated from the temperature of the boiler room to the temperature of the stack and the heat required to do this is wasted. Then come the losses from radiation of boiler, steam piping, condensation, etc., and finally there are the losses in the steam engine, first the theoretical or necessary losses, and second the unnecessary losses due to wear or improper construction, etc. After passing through this series of sieves, but 4.7 per cent. of the original quantity of heat is converted into useful work.

In the example just cited, I have taken the middle of the three cases. If I had taken the first, the thermal efficiency would have been 6.4 per cent. which is somewhat better, but if I had taken the third, 1.2 per cent. would have been our result.

One does not realize what a wasteful combination is a boiler, a steam line, and an ordinary simple steam engine.

In the above statements in regard to steam engines, I have not gone into the relative economy at full load, half load, and no load, etc., as I have not intended to go into the performance of steam engines to such a depth, but rather to show what the conditions are and the fuel consumption is in the ordinary everyday commercial use of steam.

Of course I will grant that under conditions of test, when all leaks have been stopped and all other adverse conditions have been remedied, better figures will obtain, but in general, in a plant which has been in operation for a year or two, the figures as given will be found to be correct.

There are two general types of gas engine, the 4-cycle gas engine, discovered by Beau de Rochas, in France, in 1861 or 2, and developed later by Otto, and the 2-cycle or Clerk cycle. I will not enter into discussion of the 2-cycle engine here, except as I can in a few words to describe its operation and say that in this country it has not met with the favor that has been accorded the 4-cycle engine. In general I would say that the reason that the 2-cycle engine has not met with the same favor here is because it is more complicated in construction and does not give as great economy. In this type of engine, the operation is briefly as follows: There is an explosion every revolution, starting with a cylinder in which the piston is at the beginning of the stroke, with the clearance space filled with a compressed mixture, the explosion takes place and the working or expansion stroke of the engine is passed through. The pressure generated by the explosion is expanded to the pressure of the release, the exhaust valve opens and part of the burnt gases pass out. The piston reverses its direction of travel and commences pushing out the balance of the burnt gases. Shortly after the beginning of the return stroke, the inlet valve opens and a charge of pure air is admitted. This is followed by a charge of partially compressed explosive mixture, which has been compressed in an auxiliary cylinder or pump attached to the engine. The layer of pure air advances in front of the compressed charge, which in turn is followed by the piston, and the burned gases are driven out. At a certain point in the stroke the exhaust parts are covered by the piston, the inlet valves are closed,, the compression is completed by the piston travelling to the end of its stroke and the cylinder is again ready for an explosion. In some makes of engine of this type the pure air is omitted with a resulting loss of economy.

In the 4-cycle engine the process is somewhat different, although the result is the same. The compressed mixture in the cylinder is exploded and expanded and the work of the engine done during the expansion stroke. On the return stroke the burned gases are swept out by the piston passing through the cylinder; on the next stroke in a forward direction a new charge is admitted at practically atmospheric pressure, and on the second return stroke this charge is compressed to the pressure desired before the explosion; thus the 4-cycles are completed and the engine is in a position to repeat the same. The thermal efficiency of the gas engine varies depending upon the type and upon the relative dimensions of the engine, but the amount of compression and the extent to which the expansion is carried are the important factors in determining the efficiency. The explanation of the conditions wherein 100 per cent. efficiency is an impossibility lies in the thermo dynamic discussions of the gas engine, which we will accept here. That wastes occur and that the efficiency is reduced can readily be seen from the fact that large amounts of energy are carried off by the exhaust gases in the form of both pressure and heat. The thermal efficiency is also diminished by the loss of heat which is carried off in the jacket water.

The indicated horse power is what we get, taking into consideration solely the thermal losses. There is still another loss in a gas engine or in any engine, the friction loss expressed by stating that the engine has a certain mechanical efficiency. After both the thermal efficiency and the mechanical efficiency are considered we arrive at the brake horse power of the engine. All comparisons of engines should be made on the basis of brake horse power, as in that case the varying mechanical efficiencies of engines would be credited to the engine or charged against it in their true amounts. Speaking generally, the theoretical thermal efficiencies, and with a mechanical efficiency of from 85 to 90 per cent., we get a resultant efficiency of from 30 to 40 per cent.

In actual practice we get efficiencies in the large units as high as 28 per cent. and 30 per cent., and in smaller units of 15 to 25 per cent., depending, of course, upon the type of engine and the care exercised in their construction and operation.

Large units with double acting cylinders arranged in tandem, where there is but one reciprocating mechanism, give a higher mechanical efficiency than a series of two or more single acting cylinders arranged in parallel, each with its own set of reciprocating parts. In some of the large, modern multiple cylinder engines we are getting to-day a brake horse power hour with a gas consumption of 9 cubic feet of gas reduced to atmospheric pressure.

Making a summary of our results we have as follows:

Steam Engines.	Efficiency. Per Ct.	Gas Consumption. Cu. Ft.
A. Compound steam engine plants.....	6.4	40
B. Automatic simple steam engine plants.....	4.7	54
C. Simple slide valve engine plants less than...	2.0	85

Gas Engines.	Efficiency. Per Ct.	Gas Consumption. Cu. Ft.
A. Large multiple cylinder gas engine plants...	28	9
B. Medium gas engine plants.....	20	12 8
C. Small gas engine plants	15	17 1

Comparing class (A) of steam engines with class (A) of gas engines we have a ratio of 1 to 4.25 in favor of the gas engine. Comparing class (B) we have a ratio of 1 to 4:2, and in class (C) we have a ratio of 1 to 4.9. Reducing our figures to cost of power, and taking into consideration the different gas rates, we got a saving of almost 50 per cent. in practically all installations.

The repairs on gas engine plants (and I only refer to high grade gas engines) are very much less than on steam boiler and engine plants, and the operating expenses of the gas engine plant shows as great a percentage of saving as the fuel end of the question.

Discussion.

The President—You have heard the reading of this valuable paper, and I am sure the thanks of the meeting are due to Mr. Welch. Now we trust there will be considerable discussion on this subject, and we are ready to hear from anyone in the room.

Mr. McDowell—Mr. President, may I say a word first?

The President—Mr. McDowell, we are glad to hear from you.

Mr. McDowell—In the year 1887 there were practically no gas engines

used in this country outside of Philadelphia and Baltimore. The Otto and the White-Middleton—one in Philadelphia and one in Baltimore—were the only ones built; they were very high priced and were used in very rare instances. In my early experience with the gas engine I conceived the idea of adapting the machine to the pumping of oil wells, for which purpose an engine was purchased and introduced by the Ohio Oil Company; but the people in charge cared very little whether it was operated or not, and it was not a success at this time. Later I finally succeeded in getting a committee appointed to take up the question of gas engine, which I considered very important, because there is scarcely an oil well that does not produce gas enough to pump itself with that gas, and I felt sure the gas engine was bound to enter the field sooner or later; and from that beginning the gas engine business has grown, until to-day there are over 40,000 gas engines in use pumping oil wells. Seeing the advantage of the gas engine in this particular work, it was then adapted to the pumping of oil through oil lines, and it has gradually worked its way up, I may say, mainly from that source; and since I have been connected with the gas business I have encouraged the use of the gas engine, because it is the cheapest type of power known. Many of its advantages cannot be told in hours, but I would mention the difference in the cost of operating a gas engine as against other fuel, the matter of repairs, etc. You know what it costs to repair boilers; there are continuous costs, and you must always be ready to do repairing; you must always have an extra boiler in order to be able to carry on continuous work. There are a thousand and one things to happen to throw the boiler out of commission, which will be eliminated with the use of a gas engine. Another item and a very important one in the larger cities is in the question of space. In many, many places the space utilized by the boiler in the power plant prohibits its use or necessitates its removal from that location. A gas engine plant can be installed in less than one-third the space required by a boiler plant; and comparing the cost of repairs between a gas engine and a steam engine, the cost is very much less on a gas engine, and there need be no hesitancy in installing the gas engine where continuous operation is necessary. At the Keystone Bank in Pittsburgh there are in use 4 Westinghouse engines—2 of 175-horse power and 2 of 125-horse power. These engines have been in operation here for 4 years. I have watched their operation during this time, and I say to you that we are generating horse power at less than ½ cent per kilowatt hour in the plant. The normal running of the plant does not require over 10 cubic feet of gas per hour and the actual repairs on the 4 engines cost less than $100 per year. Two men are employed to look after the engines which supply all the power used in the building, run the elevators and furnish the lights; and there is no fear of breakdowns to interfere with continuous operation. We are operating at the present time seven 1,000 horse power gas engines.

Mr. Hackstaff—In figuring gas engine in this territory, a first-class engine will develop horse power per hour on about 12 cubic feet of gas, which figures about three times cheaper than anybody can produce it with steam; about three times as cheap as the price I have heard quoted by electric concerns, and this ought to appeal to any user of power. In figuring this territory from St. Joseph to Joplin, the average consumer using Cherokee lump coal can put in a gas engine plant, charging up 6 per cent. on his investment; 10 per cent. depreciation on his plant, and pay for the plant complete in 3 years out of the saving.

Mr. McDowell—What is the original cost of the plant?

Mr. Hackstaff—Figuring on a complete exchange in a large plant where the power is to be used in an electric railway with an average load of 1,000 K. W. per hour for 20 hours, the engine to be connected to a 1,500 K. W. alternator capable of 100 per cent. overload—the complete exchange would cost about $150,000 against within $10,000 of that amount for a steam system; but the saving in the use of the gas would be about $1,000 a month or $12,000 a year which would take care of the interest charges, etc., on the plant.

Mr. Pattison—In plants from 100 to 500-horse power, would the percentage be the same?

Mr. Hackstaff—About the same percentage; you can figure that a gas engine installed complete will cost about $40 per horse power. In figuring with the Katy Railway officials down at Parsons on a new power plant they are putting in, they claim a steam plant installed complete, with the wheels running around, costs from $37 to $38 per horse power; a very small difference with the difference in the cost of the fuel running about 50 per cent.

Mr. Pattison—A great many users of gas often ask this question: "If we buy a gas engine, how long can we use it; and if natural gas should play out in a few years, can the engine be used on producer gas?

Mr. Hackstaff—A slight adjustment of the valve would be necessary on account of the slight difference in the calorific value of the gas. The life of a gas engine is reckoned as being better than the life of a steam engine.

The President—Mr. Barnes, let us hear from you.

Mr. Barnes—I do not know that I can add anything to what has already been said, except that I might say a little more than Mr. Hackstaff has said in regard to the change. After a change from natural gas to producer gas, or manufactured gas, or any other gas, has been discussed, a question may rise in view of the fact that a producer gas engine is built on entirely different lines—that is the areas are larger, and there are a number of different features in the construction of the engine; but the most you can say is that you would have to put a new cylinder on it, of which any engine man would know about what the cost would be; but the gains all through these years and with the continued gain—although not in the same proportion, because the gas would not be so cheap—should be a talking point in inducing a man to make the change. Nearly all the plants installed to-day for natural gas have in view in some distance the future manufacture of coal or water gas, or both, or some other form of manufactured gas, to take the place largely of natural gas, and many plants, in changing over from artificial to natural gas, are making provision for large increase of distribution; for the people, after using natural gas, will have been so educated to gas that the business will not drop off, but will grow. That has been the experience of Indianapolis where the gas distribution per capita to-day is three or four times what it was before the introduction of natural gas and the subsequent exhaustion of it. This is due largely to the new uses to which they have learned to put gas.

Mr. Whithead—I should like to ask if it is the custom to charge ordinary domestic rates on gas engines from 100 to 1,000-horse power or larger?

The President—Mr. Sears is probably more familiar with that point than anyone else; let us hear from him.

Mr. Sears—Twenty-five cents is the rate generally used for gas engines. Mr. Mitchell would be more familiar with the rate charged in St. Joseph than I am, but 25 cents is the universal rate irrespective of size.

The President—In St. Joseph in figuring natural gas at 30 cents against the cost of any other fuel, the gas figures so much cheaper, there is no occasion for cutting the price on gas for gas engines; even on a large installation, we do not feel that we will have to cut the price. Mr. Hackstaff was with us the other day, and in figuring in competition with the Electric Light Company who had offered electricity at 1½ cents per K.W. we find with gas at 30 cents per 1,000 cubic feet, power can be produced and all the expenses—that is, the interest on the investment, depreciation, etc.—can be taken care of for 1 cent per K. W.; so it was not necessary to have the price of gas reduced. Thirty cents is cheap enough, in my judgment, in competition with other fuel.

Mr. Bullock—The Jasper County Light and Fuel Company have installed in the last 6 months about 300 gas engines ranging from 80 to 150-horse power, and are receiving for the gas used under these engines 25 cents net. Even with the cheap 2-cycle engine we have showed a great saving over the cost of boiler horse power; so much so that great interest is taken in the gas engine business, and we believe we will be able to put on at least one-half of our consumption in the Jasper County Light and Fuel Company within the next 10 months with the gas engine. While I believe it is not generally the right thing for people interested in the gas business to recommend any particular make of engine, from my experience in the last 6 months about 300 gas engines ranging from 80 to 150 of engines among our customers, because they easily get out of order; the consumption of gas is much larger, and they are more apt to shut down and give trouble than a good first-class 4 cycle engine.

Mr. McDowell—I will say that most of Mr. Bullock's business down there is manufacturing business. In Jasper county and the adjoining county in Kansas they are supplying about 500 manufacturing concerns at the present time, and as near as I can recall there are some 50 or 60 gas engines contracted for there now. The saving is so great they have no hesitancy in going on with the business. I should like to mention one other matter. For a number of years we ran a shop in which was installed a 60-horse power gas engine, and in the 3 years we ran it we never had an engineer. The foreman of the shop started it in the morning and shut it down at night, and that is pretty nearly all you have to do.

Mr. Holmes—I believe the rate question can be fairly well answered by suggesting that the gas companies charge a sliding scale for gas

used in gas engines, whereby they start with the domestic rate for a certain amount of gas, and after the consumer consumes over that amount he gets a reduction on the second lump amount. I think perhaps Mr. McDowell could give us some light on that subject from his experience in Pittsburgh. It puts everybody on the same basis, and the consumer using the greatest amount of gas, of course, gets the benefit of the low rate without wasting the gas to get it.

Mr. McKenzie—We are charging a 25-cent rate for gas engines up to 400,000 feet, and we have not made a rate beyond that as yet.

Mr. Sweetman—In answer to this question regarding the sliding scale for a gas engine, I should like to ask if it is not the case that the larger the gas engine put in the less the cost per horse power. That is, you say that a gas engine costs 3 cents per horse power per hour of a given size, and you increase that to a great deal larger size, would it not cost 2 cents per horse power per hour? And in that way, would the consumer not make a sliding scale for himself in the size engine he put in?

Mr. McDowell—The consumption per horse power per hour per engine varies from 9 cubic feet in a large size to 15 cubic feet in the smallest engine. Any engine man will guarantee these results.

Mr. Sweetman—Just as I said, the size of the engine takes care of the sliding scale itself.

The President—Mr. Young, have you anything to offer on the gas engine proposition?

Mr. Young—My experience is about the same as Mr. Bullock's, we being in the same locality and working under the same conditions.

Mr. Williams—In regard to the question a customer may ask when buying a gas engine for natural gas: "Can we change this over to artificial gas?" This does not hold in the case of a small engine as in a large one for the reason that if it comes to a show-down, the small engine can be changed to burn gasoline or crude oil; and in purchasing a small engine, the man will say, "Well, I will put that in while natural gas is here, and if it gives out, I can make a little change in the engine at a small cost and run it ahead with crude oil or gasoline."

Mr. Lloyd—Our engines are of small type and we find they are so economical it is hardly worth collecting the bills and bothering with them. It is not necessary to quarrel over these small engines, they are not worth the trouble and time it requires to get them on.

The President—I remember a great many years ago—about 20 years ago—we started in in St. Joseph to increase our output of gas; and to assist us in this effort we encouraged the use of the gas engine, the old Otto slide valve; you all remember the brass slide valve at the end, and I used to make it my special business to see that the gas engines were going, but all that has been done away with now. We have an engine which a child might start, whereas the old way it took a man with a good heart and a good pair of lungs to start the engine. As I say all that has been done away with, and we can start our gas engines as easily as we could an electric motor. Now, does anyone else want to say a word on this subject of gas engines? If not, we might close our proceedings at this time, and let the meeting stand adjourned until 1:30 this afternoon, when we will continue our programme.

The President announced that a dinner had been arranged for downstairs, which, if it was as good as the dinner he ate there when attending the previous meeting, would be very acceptable to each and every member, and that it would cost them only $1 apiece. The meeting thereupon adjourned.

First Day—Afternoon Session.

The President, after calling the meeting to order, stated that the financial report of the Secretary would be given at this time, as it had been omitted at the morning session. This report showed that up to June 11, 1906, after expenses amounting to $111.40 had been paid, there still remained on hand $135.60. The President stated that this report had been carefully gone over by the Auditing Committee, and found correct, and that if there were no objections, the report would be received and entered upon the minutes. The President next stated that he wished to appoint a committee to decide on the meeting place of the Association next May, and named on this Committee the following gentlemen: Mr. E. S. Springer, Chairman; Mr. C. L. Bullock, Mr. C. W. Sears.

Mr. A. G. Holmes then presented his papers on Gas Meters and Volume and Pressure Recording Gauge, as follows:

GAS METERS FOR DOMESTIC CONSUMERS.

Although natural gas was utilized for lighting and heating purposes at Fredonia, N. Y., as early as the year 1821, it was not until it was introduced into the Pittsburgh district in or about the year 1880, that its use on a large scale began, and the various problems in connection with its production, transportation, control and distribution received serious and careful attention.

At first the idea was seriously entertained by many that the supply was inexhaustible and it therefore made little difference whether or not any steps were taken looking to its economical consumption or to the amount delivered to individual consumers, so long as the mains were capable of transporting a supply adequate to meet all existing demands.

This foolish and erroneous idea was gradually dissipated, however, and then the natural gas companies began to install meters on all consumers, changing from the contract to the meter method of charging for gas.

At this time the only gas meter available was the ordinary tin case dry meter used for the measurement of manufactured gas. Some of these meters were installed by the gas companies which first supplied natural gas in the city of Pittsburgh, and also by other natural gas companies located elsewhere. No fault was found with this type of meter with regard to its measuring qualities. However, as the meter was only intended to withstand the low pressure under which manufactured gas is distributed, it was unfitted, by reason of its light construction, to withstand the higher pressures then prevailing on natural gas lines. Furthermore, at this period, the devices for reducing, regulating and controlling the pressure to a point suitable for domestic consumers had not been brought to their present perfect state, and when these devices failed to operate properly, which was not infrequent, the meter, being unequal to the high pressure suddenly thrown upon it, would burst, resulting occasionally in gas explosions or other damage, in addition to ruining the meter.

In order to meet existing conditions, it was felt that a special meter must be designed for natural gas service, and this problem engaged the serious attention of Mr. George Westinghouse, who was at that time actively interested in developing the possibilities of natural gas as a convenient and economical form of fuel. His experiments along his line resulted in the invention of the Westinghouse fluid gas meter, which was then placed on the market, and which has since become so well known throughout all the natural gas fields.

This meter met every requirement. It was accurate, durable and reliable, and being constructed entirely of metal, with cast iron outer casings, it could be furnished to withstand any desired pressure.

The success of the Westinghouse fluid meter was phenomenal, and it quickly became, and has remained to the present time, the standard case meter for the accurate measurement of natural gas.

Of late years the gradual but certain depletion of the older natural gas fields has been an incentive to the companies engaged in the natural gas industry to take a more distant view into the future, and, so far as possible, anticipate and provide for the inevitable failure of the natural gas supply. This same thoughtfulness should be exercised by all natural gas companies, for we all know that history repeats itself. As a result of this realization on the part of the gas companies that it is only a question of time until the failure of natural gas will compel the substitution of the manufactured article, all their equipment, so far as practicable, is installed with this end in view. This has been one of the principal reasons for the gradual return to the use of the 2 diaphragm tin case dry gas meter by all of the leading natural gas companies.

That the natural gas companies are able to take this step is due to the fact that the old conditions which compelled the use of the iron case meter no longer exist. For example, the extremely high rock pressure formerly prevailing (and which still prevails in some fields) was liable to be thrown on the distribution pipes at any time through failure of the regulators to work properly, but is now under positive control, except, perhaps, in isolated cases, such as in towns where no attention is given to this particular point. The regulating and controlling devices now in use have been brought to such a high state of perfection that such accidents are unheard of. The conditions at present existing on most natural gas distribution lines, as regards uniformity of pressure, approximate closely those under which manufactured gas is distributed. Therefore the same meters are equally applicable to both classes of service.

The foregoing reasons, reinforced by the additional ones about to be cited with reference to the advantages of the tin case dry gas meter over the iron case meter, will explain why the former type is finding such favor with the natural gas fraternity at the present time.

The tin case dry gas meter of the 2 diaphragm slide-valve type has many advantages for the measurement of either natural or manufactured gas, a few of which are worth mentioning, viz:

With any given absorption they have a greater capacity than all other types of positive meters.

They will accurately register small volumes of gas which other types will totally fail to record.

The valves are not so easily affected by dirt or water, and being of the D slide type, clean themselves readily.

When the pressure is low, or gas is scarce, tin meters will allow more gas to pass through them than will a given size of any other type of meter.

Tin meters cannot easily be tampered with without detection, and one seal on the inlet connection makes them perfectly secure in this respect.

As previously stated, they can, if necessary, be used for manufactured gas in the event of the natural gas supply failing.

The first cost for a given capacity is much less.

Tin meters work much slower, consequently wear much longer.

The inlet pressure being on top of the valves, instead of underneath, as is the case with iron meters, makes it possible to get more gas through the meter than is registered. Whereas, with the pressure under the valves, gas passes through without being registered when the weight of the valve is overcome by the differential in pressure.

If so desired tin meters may be changed from regular to prepayment meters.

They are much lighter than iron meters; are easier to handle, and, in many instances, can be readily set in a desirable position where it would be impossible to set iron meters.

For low points on dead ends, which are encountered in all gas plants, they are the only satisfactory meters procurable.

As a further protection, and to better enable them to stand the strain of direct connection to iron pipe, the screws of meters intended for natural gas may be riveted to the meter cases.

LARGE CAPACITY OR "A" DRY GAS METERS.

The advantages that have just been mentioned apply equally to all types of tin case dry gas meters. However, I desire to call your special attention to another meter of this type which is now being manufactured. This meter is designated as the large capacity or "A" meter, and is especially adapted to natural gas service, as will presently appear.

In order to give you a general idea of the reasons for designing and manufacturing this meter, I will outline briefly a few of the conditions existing in the manufacture of dry gas meters of the ordinary type in current use.

Previous to the appearance of the large capacity or "A" meter, the ordinary or low capacity meter had been manufactured and used in practically an unchanged form for 60 years.

During all this time the various meter manufacturers produced meters having the same designated rating in lights and of approximately the same outer dimensions per given size, but which conformed to no fixed standard of size or capacity. The meters also varied widely in capacity per given size as between the different makes, and there was even considerable variation in separate lots of the same make and rated size when manufactured at different periods. This lack of uniformity in size and capacity naturally caused the gas companies a lot of trouble and confusion in the endeavor to select for any particular service a suitable meter having the proper capacity, as it was impossible to tell from the meter's rating in lights just what its actual capacity in cubic feet per hour might be. In some instances it was found that a 3 light meter of one manufacturer had a larger capacity than the 5 light meter of another manufacturer. And, as has just been mentioned, one size of a certain maker's meters might have a certain capacity, while another lot of the same size and same rating in lights from the same manufacturer might have an entirely different capacity.

In addition, it was clearly demonstrated by carefully conducted experiments and trials under the supervision of the most competent gas engineers, that certain sizes of meters were not giving the capacity of which they were capable, and as a result a large percentage of the possible efficiency of the machine was unavailable for service.

The object of these experiments was to indicate along what lines the dry gas meter could be changed and improved in order to make it a more efficient and uniform measuring instrument.

The ideas were incorporated in the designing of the Westinghouse large capacity or "A" meter, some of the advantages of which will be mentioned briefly.

1. Instead of the meters being designated as 3-light, 5-light, 10-light, etc., which designations do not convey any clear idea of their actual capacity in cubic feet, the "A" meters are designated as 3 "A," 5 "A," 10 "A," etc., and each of these designations stands for a definite and guaranteed capacity in cubic feet per hour with a given absorption or differential, so that when a meter is desired of a certain capacity it will at once be known just what size meter of this type to select for the service.

2. The greatly increased capacity of the meter is obtained by enlarging the gas channels and valves, and by eliminating all acute angles tending to obstruct the free flow of the gas.

For natural gas service, where the amount of gas used per meter is greatly in excess of that registered by meters on manufactured gas service, the greatly increased capacity of the "A" meter makes it especially desirable.

In order that you may fully realize the great gain in capacity of the "A" meters over the ordinary type, I would ask you to note the comparison between the different sizes, comparing the 3 "A" with the 3-light, the 5 "A" with the 5-light, the 10 "A" with the 10-light, etc., the meters compared with each other being identical in outer dimensions and in the size of the connections. In other words, a 3-light meter may be removed from a service and a 3 "A" meter inserted in its place without making any alteration in the existing piping or connections.

The capacities of the respective sizes, with a differential or absorption of .5 per cent. of water, are as follows:

Westinghouse Large Capacity or "A" Meters.	Small Capacity or Ordinary Meters.	Percentage of Inc. of "A" Meters Over the Ordinary Meters.
3 "A"....120 cu. ft.	3-light.... 66 cu. ft.	82 per cent.
5 "A"....200 "	5-light ... 95 "	110 "
10 "A"....375 "	10-light....141 "	234 "
20 "A"....600 "	20-light....218 "	175 "

The diaphragms are made slightly smaller than those of the ordinary meter, and in consequence they do not touch the meter cases at top, bottom or sides, which prevents them from becoming covered with the condensation which gathers on the inner walls of the meter cases, which condensations, when coming in contact with the diaphragms, as it does in the ordinary meter, causes them to stick, grow hard, crack and finally rot. As experience has demonstrated that the diaphragms do not actually wear out, but gradually deteriorate from the action of the gas upon them, this feature of non-touching diaphragms adds greatly to the life of the meter.

3. The valves, valve arms, stuffing boxes, flag wires, flag arms and other working parts of the meter are made especially strong, enabling this meter to stand with ease the somewhat higher pressure and harder service encountered in the measurement of natural gas.

The question of absorption in a meter is of vital importance to the supplier of natural gas and should be carefully considered. For example, a so-called 300 feet per hour iron case meter requires at least 2 inches, or more than an ounce pressure to operate it, while a 5 "A" meter will pass accurately 300 cubic feet per hour with an absorption of less than 1 inch.

In reply to this assertion, the supplier may say, "That is quite true, but what do we care for the absorption when we have 4, 6 or 8 ounces on our line?" You may not care so long as you have that pressure and so long as you are satisfied with the revenue you receive for gas supplied at that pressure, as compared with 2 or 3-ounce gas, as is the case in the neighboring city of Kansas City, Kas. But let us look at it from another standpoint. Suppose that after a short term of service there is a perforation in the diaphragm of the meter which requires an absorption of 2 inches to operate, will not the leakage through that perforation be much greater with a drop of 2 inches than with less than 1 inch and when will the leakage be most detrimental to the supplier? In the winter months, of course, when the consumer is using most gas and the meter is operated nearer its maximum capacity, at which time the absorption will be greatest.

Or, suppose during cold weather, when you need every foot of gas in the lines, but, unfortunately, your pressure unexpectadly drops; then is when both the gas company and the consumer appreciate the meter with the low absorption, because, if there is an ounce pressure, or about 17-tenths inches, in the line, the consumer gets 15-tenths of it through a 5 "A" meter, but none at all through the meter that requires 20-tenths inches to operate.

If the town is hilly, the high parts get gas without trouble, but it will not flow down so easily, and for the consumers in the low districts the low absorption meter comes in again.

The gas man "has troubles of his own," but low pressure will make him "take to the tall timbers" to escape complaining consumers probably oftener than any of his other troubles.

Taken altogether, it must be admitted by all thoughtful men who have given the subject careful consideration, or who will now give it its proper consideration, that the meter you want is the one that will pass accurately the greatest volume with the least absorption, and do it for a long term of years, and to that there is only one answer.

VOLUME AND PRESSURE RECORDING GAUGE.

In supplying natural gas by meter measurement to gas companies,

manufacturers or other large consumers, it has heretofore been found impossible to definitely determine the exact volume, owing to the absence of automatic recording devices for both volume and pressure at the same time and on the same record, more especially when the pressure is high and subject to wide variations.

Gas meters being volume measurers only and the number of heat and light units being dependent upon the density of the gas, when making a contract to furnish gas in large quantities the supplier or producer generally agrees with the buyer or consumer of the gas upon some given constant pressure as a basis upon which all sales of gas as indicated by the meter are to be computed, making use of a table of multipliers, compiled from a well-known law regarding volume of gas under different pressures, for determining the quantity to be paid for when the gas is passed through the meter at pressures other than that specified in the contract.

Inasmuch as the pressure of gas supplied to consumers is subject to considerable variation from time to time, and the volume of gas used also varies during any given period of service, it is always advisable to have a record of amount of gas supplied to the consumer at the various intervals of time during the operation of the meter, and also to have a complete record of the variations in the gas pressure at such intervals.

Heretofore the means usually adopted for obtaining a record of the volume and pressure of gas passing through the meter at given periods of time was to have a man take frequent readings of the meter, also noting the pressure at each reading, or the latter was sometimes obtained by the use of an ordinary recording pressure gauge. The employment of a man for this purpose was naturally a rather expensive method on account of the widely scattered locations of the meters; besides, this method did not furnish a complete record of the performance of each meter at all times, as the volume and pressure might fluctuate greatly during the intervals between the readings without being detected by the meter reader when making his periodical visits, while the recording gauge indicated pressure only and the various pressures thus shown had to be averaged.

The device which is here illustrated and described provides a simple, practical and efficient means for securing the desired information. (Showing pamphlet.)

This volume and pressure recording gauge, when used in connection with a Westinghouse gas meter or a Westinghouse proportional gas meter, and it can be used with no other make or kind, will furnish automatically a complete and accurate record of not only the pressure, but also the volume of gas passing through the meter at any and all times during the day or night, the only attention required being the substitution of a new chart every 24 hours.

This device, so far as general appearance and the recording of the pressure are concerned is identical with the ordinary recording gauge in current use, with which you are no doubt familiar. You will note from the illustration here shown the method of attaching this device to a proportional meter.

By reference to the illustration of the chart here shown, it will be noted that there are two separate and distinct lines or records traced upon it, the outer line indicating volume, and the inner line pressure.

There being nothing essentially new or novel in the means of obtaining the record of the pressure, I will confine my explanation to the method of obtaining the record of the volume of gas passing through the meter, which I will describe in detail.

This record is made by means of the stylus or marking point attached to the free end of an arm, the latter extending downward and connecting with the crank on one of the circles of the meter dial, and this arm is so adjusted that when the crank on the circle of the dial to which it is connected makes a complete revolution, the stylus of marking point will record one backward and one forward stroke, these two stroke combined being equivalent to the volume indicated by the circle of the dial to which the arm is attached. The number or frequency of these registered by the meter, and, in consequence, the stroke, will be short and acute or long and obtuse, depending upon whether the consumption is large or small. The time periods indicated on the margin of the chart are for the purpose of telling exactly the amount of gas that has passed through the meter for any certain period of time, and the total registration shown on the chart for the 24 hours will, of course, tally with the amount indicated by the meter dial for the corresponding period.

On the chart each hour is divided into quarter hour periods, which will permit of very accurate figuring should the pressure vary greatly within the hour.

By the use of this pressure and volume recording gauge in connection with the meter, it is obvious that the supplier of gas will be in possession of a complete record of the amount of gas passing through a meter at all times, and will also know exactly at what pressure each and every thousand cubic feet has been registered. This will enable him, therefore, to compute his bills accordingly and thus obtain proper payment for all gas furnished upon the basis agreed.

In addition to the principle object just mentioned, this volume and pressure recording gauge will give valuable information along many other lines. For example:

1. It will indicate at what period of the day or night the consumption is the heaviest, and thus allow of the proper measures to be taken to furnish an adequate supply at such times.

2. By furnishing a complete record of the performance of the meter at all times, with the corresponding pressure, it will prevent the consumer from claiming a shortage in the gas supply in cases where the trouble is due to other causes.

3. Should the line between the meter and the point of consumption spring a leak or break from any cause, the trouble will be promptly detected by the abnormal registration indicated by the chart, which will also indicate the exact time the accident took place, and in addition, indicate a possible reduction in pressure if the leak is of great magnitude.

4. If, for any reason, the meter should cease registering, the fact would be instantly noted on the chart by reason of the volume band or pointer tracing an undeviating circular line around the margin of the chart, commencing at the moment stoppage occurred.

5. Anything abnormal in the pressure or the volume of gas registered would at once appear on the chart, and steps could be taken immediately to locate the cause thereof. This feature alone will prove exceedingly valuable, and will often be the means of obviating disputies between the buyer and the seller of gas.

6. The device will practically serve as a watchman's clock or time detector, enabling the official in charge to keep accurate tally on the regularity with which the man in the field visits the meter.

7. By carefully filing away all charts, a complete record will be had of each meter, which may prove of great value for future reference.

Many more examples of the utility of this device might be mentioned, but the foregoing will suffice to convey a general idea of its value.

Your special attention is, however, directed to the *time* feature of this device, which makes it particularly valuable.

This volume and pressure recording gauge operates by clock mechanism and is independent of the meter, and for this reason its usefulness is increased many times more than if its operation were dependent upon the operation of the meter, *i. e.*, going when the meter goes, and stopping also when the meter stops.

In order to illustrate one of the many ways in which this device has demonstrated its practical value to both buyer and seller of gas I will relate an incident which occurred some time ago.

One of the gas companies in the Pittsburgh district was buying natural gas from a certain producer by meter measurement, for which purpose a Westinghouse proportional meter equipped with a volume and pressure recording attachment was employed, the seller of the gas agreeing to deliver it to the gas company at their main, which was several miles from the point of production. For the seller's convenience, however, it was further agreed that the meter be located on the line leading from the wells to the gas company's main, but some distance from the latter, it being understood that the seller of the gas was to be responsible for keeping his line free from leaks and in good condition up to the point it joined the gas company's main. Through carelessness in the supply line *between the meter and the main line*, and during an extremely cold spell, the line froze up and then burst. This, of course, allowed the gas to escape into the open air until the break was discovered and turned off.

When the time came to adjust the charge for the gas furnished, in order to make proper deduction for the quantity that escaped. all it was necessary to do was to refer to the chart covering the day on which the accident to the pipe occured. This chart indicated the following:

1. The exact time at which the line froze up, as indicated by the stoppage of the meter and the great increase in pressure.

2. The exact time when the line burst, as indciated by the great drop in pressure and the sudden starting of the meter and its abnormal registration up to the time gas was turned off.

3. The exact time at which the gas was turned off.

4. The exact amount of gas that escaped on account of pipe bursting.

As the supplier of the gas was responsible for its safe delivery to the gas company's main, he, of course, had to bear the loss, and therefore, the amount, as indicated by the chart, was deducted from the total registration of the meter.

You can readily see that had an ordinary meter been placed on this service, none of the information indicated by the chart would have been available in making an adjustment of the charge, and, in con-

sequence, it might have led to dispute and litigation, and especially where the amou nt involved was large, as in this case.

Discussion.

Mr. McDowell—I should like to ask Mr. Holmes what the capacity of the new di iphragm is as compared with the other?

Mr. Holmes—As compared with the 3-light or 3-A?

Mr. McDowell—Do I understand you to say a 3-A passes 200 feet an hour?

Mr. H olmes—No, a 5-A, Mr. McDowell.

Mr. McDowell—A 5-A meter passes 200 feet an hour and a 5-light passes 95 feet; but the 5-A runs 8 revolutions while the 5-light runs 6. Then the bellows must be larger in the 5-A?

Mr. Holmes—No, it is smaller.

Mr. McDowell—Then I have been lying to the people, because it always occurred to me that you cannot pass more gas through because this bellows fills and exhausts and fills again, and unless the mechanism is entirely different, the valve must travel faster.

Mr. Holmes—It does travel one-third faster; that is, the more gas you put through the meter, the more revolutions it must make.

Mr. McDowell—But how a meter of so much larger capacity than another can make only 2 revolntions more is something I cannot understand.

Mr. Holmes—Like you, at first I could not understand this either; but we have found that the old meter would not let the gas through, but by increasing the size of the channels and the ports of the valve, with a slightly smaller diaphragm, we got an increased capacity, the meter running only 2 revolutions faster.

Mr. McDowell—How many revolutions per minute does this A meter run?

Mr. Holmes—It has a capacity of 200 feet an hour, making 1,600 revolutions in that time, or 8 revolutions per minute; while a 5-light with a capacity of 95 feet make 1,200 revolutions in an hour, or 6 revolutions per minute.

Mr. McDowell—In other words, the less the number of bellows movements in the meter, the more gas it passes.

Mr. Holmes—No, there are more; you can put a 5-light diaphragm in a 5-A meter and it will run exactly the same number of revolutions; that is, it will run no faster for the same number of feet.

Mr. McDow ell—But if you want to get more gas through it, it will have to run faster. Is that the idea?

Mr. Holmes—Yes, if you put more gas through it it must make more revolutions.

Mr. McDowell—But the only way to pass more gas is to increase the speed. Now, that is what I wanted to bring out, and it is a question in my mind of how long a meter will last which is subjected to such rapid motion. The real thing for which I fear is that this meter of so much larger capacity and no larger in size will not wear at the speed at which it must run.

Mr. Welch—As I understand it, the diaphragm is decreased in size for the same amount of gas through the same size meter, but the speed is increased to get a larger capacity.

Mr. Holmes—That is right.

Mr. McDowell—Then, Mr. Holmes, the only advantage, as I understand it, is securing a meter that will pass more gas with a smaller diaphragm is to cheapen the meter—that is, get a larger capacity for the same money.

Mr. Holmes—Gas companies for years have wanted a meter of large capacity, because they claimed they were not getting the proper capacity. and the meter company has endeavored to give them a meter that will pass more gas with no advance in the price of the meter, by simply making the same size meter run more rapidly. This matter has been talked over among artificial gas companies for years and the best engineers in the country have studied over this matter and have come to the conclusion that the meter has not really been cheapened by having its capacity changed, and they do not figure that increased speed will be detrimental to the meter. The United Gas Improvement Company have considered this matter very thoroughly; the A meter is being used in the Philadelphia plant, and they have made it a rule to change all meters from the old to the new style.

Mr. McKenzie—As I understand it, the economy in the use of a 5-A or a 10-A meter lies in the fact that they can buy a 10-A meter instead of a 20-light or a 5-A instead of a 10-light.

Mr. Springer—I was informed a few months ago that the manufacturers of the old line of tin meters promised an increased capacity tin meter very shortly; does anybody know on what lines they are working, and how soon they expect to get that meter to us?

Mr. McKenzie—Do you mean for domestic consumption? That type has been on the market for 3 or 4 years.

Mr. Springer—No; this type "A" has been on the market that long, but this was to be of another type. They promised me 6 months ago that this meter would be on the market before this time, and I just wondered if anybody present knew anything about it.

Mr. Holmes—The Pittsburgh Meter Company make old-time tin meters the same as other people; also they are prepared to make any other kind of meter a gas company may want. We can give you what we call a 5-light gas meter, passing 95 feet an hour, 150 or 200 feet, it being only a matter of making the valves and valve channels of certain size to let that amount of gas through.

The President—I believe what the artificial and natural gas people want is a meter that will give increased capacity at the same cost and also low differential pressure. We can get meters that will pass a large amount of gas, but it takes about half the pressure to get the gas through it. Now, if we can get a meter to pass the gas and give us low pressure to pass the gas through the meter, that is something we very much desire, and I am inclined to knock on the 5 "A" meter, because it does seem to run faster and to wear out. Now, a word in regard to the meter. It is one of the greatest inventions of the age. The old meter runs and registers correctly year after year without much if any attention. Talk about new inventions for the meter—I say what is the matter with the old meter? It is good enough. The only trouble is in getting it to pass a larger amount of gas; that is what we are getting into now. Changing from artificial to natural gas, we want a meter that will pass the gas to the furnace as well as to the cook stove and the illuminating pipes. At the present time we have to change the meter when putting on the furnace, and if we could get a meter with larger openings so we could let the gas through to these appliances without changing the meter, that is something we very much desire

Mr. McKenzie—I should like to ask Mr. Holmes if he has had any complaints with his meters on account of the noise they make with natural gas.

Mr. Holmes—We have had no complaints, except in the case of one man who said our meter was making a noise, and we found it was another make of meter. But I don't say they won't make a noise.

Mr. McKenzie—Since turning on the natural gas we have put in a great many large capacity meters. Of course, we do not know how long they are going to last, but we do not anticipate much trouble along this line. However, most of the complaints last winter in using large capacity meters were due to the horrible noise they made. Some of them made as much noise as a box of cats in the cellar. This trouble might be explained from the fact that natural gas is a great deal dryer than artificial gas; we don't have that noise on artificial gas.

Mr. McDowell—We have had the same difficulty in a dozen towns in cases where the meter was too s nall and it had to travel too fast. In my judgment the meter having to travel too fast is what causes the noise. You will have no trouble when the meter is working slowly, but on a cold day when it has to travel very fast you will notice this noise.

Mr. McMenzie—I do not believe that will hold in all cas s; we have had just as much noise on a warm day as on a cold one.

The President—I believe the meter in that case is dry, and if you will oil it I believe the noise will be stopped.

Mr. McDowell—The customer will not let you oil the meter.

Mr. Mitchell—I should think he would rather have the meter oiled than to have that noise of which Mr. McKenzie speaks.

Mr. McDowell—This discussion reminds me of an instance in the early days when the first iron dry meter was put on the market; it made a great noise; every time it turned over you could hear the vibrations all over the house. One of these meters was put in the house of an old Irish lady, and the noise became very trying to the old lady who was a sort of a leader in her ward, and she made the situation very annoying to us; so Mr. Strong, one of our men, said he would stop and see Mrs. Murphy about the matter the first time he passed her house. So one day he called, and Mrs. Murphy expressed herself as being very glad to have the honor of his presence at her house, and assured him there would be no further trouble or objection on her part to having a meter in her cellar; but he had hardly left her when she remarked: "Niver mind, Mr. Strong; it's all right what I said about that meter; but just as soon as another line passes my house that clucking son-of-a-gun goes out of my cellar."

Mr. Dunkel remarked that the metric meter, the first natural gas meter put on the market, made a noise equivalent to a noise that might have resulted had the pipe been hit about 6 times with a sledge hammer every time a foot of gas passed through the meter.

(To be Continued.)

[Prepared for the AMERICAN GAS LIGHT JOURNAL by Mr. Frederic Egner.]

Selenium and Its Significance to the Technology of Gas Lighting.[1]

[A paper read by MR. H. RAUPP, Director of the City Gas Works of Mayence, at the annual meeting of the "Mittelrheinischen Association of Gas and Water Business Men," at Mayence, Germany, 1905.]

It may be expected that selenium will in the near future become a not unimportant factor in the gas industry, and that by means of it a number of interesting questions and problems will be solved. For instance, the automatic lighting and extinguishing of street lamps will be one of them, but not by any means all.

You will find very little in literature concerning selenium and its wonderful properties, and it will probably interest you to be given this brief description which, in connection with a few simple apparatus I shall use, to show you how and in what manner selenium may be, and very likely will be, employed in the technology of gas manufacture and application of gas for illumination.

Selenium has an atomic weight of 78.49, and while by no means rare, is found generally only in small quantities, for which reason it is still classed as among the rare elements. It is related to the sulphur group, and in many respects its properties are analogous to those of sulphur. Selenium is generally found in combination with metals, such as lead, silver, quicksilver, and also with pyrites of iron and copper. In the working up of these pyrites to make sulphuric acid, selenium is found as a sediment at the bottom of the lead chambers. It was in such a one that Berzelius discovered selenium in the year 1817. In these lead chambers selenium is found as an amorphous red powder, which by melting is converted into a black sealing wax or glass-like mass, in which condition it is practically a non-conductor of electricity. By further heating this selenium it undergoes another total change, and when heated up to 200° C. it suddenly changes into the metallic state. In that condition selenium has a slate-colored appearance; its melting point is 217° C. and specific weight 4.8. Finally, when in this metallic condition, the wonderful properties of selenium become manifested—namely, *the metallic selenium will conduct the electric current far better when exposed to light than when in the dark;* in fact, TEN TIMES AS WELL.

It is because of this property that selenium will find a useful application in the gas industry, as it has in the matter of conversion of written characters and photographs, etc., but concerning which we shall not now speak. In practice, selenium is employed in the shape of so-called selenium cells. You see here before you a pear glass, held by a metal binding similar to an incandescent electric light bulb (see Fig. 583). In this glass there is a porcelain cylinder, around which selenium is wound in the shape of very fine wire. But beside this form of the selenium cell it is also constructed in an entirely flat shape or form (see Fig. 584).

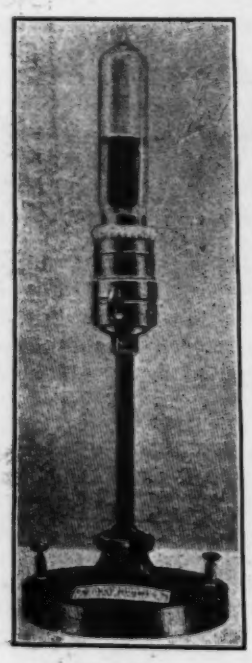

Fig. 583.

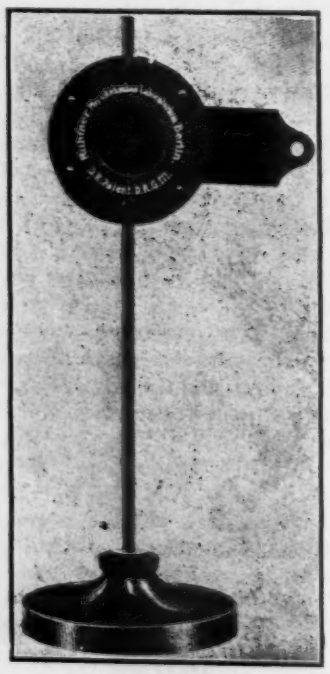

Fig. 584.

1. From the *Journal of Gas Lighting and Water Supply*, organ of the German Associations of Gas and Water Business Men, July 14, 1906.

This shape is intended to be employed where the selenium is to be exposed to light only upon one side of it. That sort of the selenium cell is manufactured in large quantities and excellent quality at the physical laboratory of Ruhmer, at Berlin.

To enable me to show you the influence of light upon a selenium cell of this sort, I have set up herewith the following apparatus (see Fig. 585).

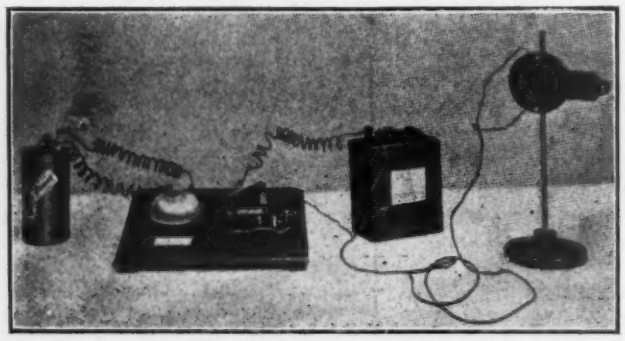

Fig. 585.

You see there a selenium cell, an element of a dry battery, and an electric transmitter with a relay. This relay is so arranged as you see *and shall hear* that, when the selenium cell is subjected to light, the bell will *not* ring; but when it is darkened the bell will ring (demonstration). Upon this circumstance rests the construction of an apparatus for the gas industry, which I regret to-day to be only able to show yon in the form of a model (see Fig. 586).

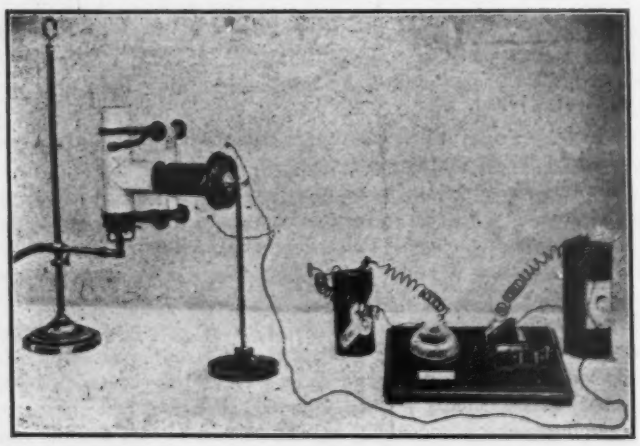

Fig. 586.

The selenium cell shown is continually illuminated by means of a small gas jet or incandescent electric light. Between this flame and the selenium cell is arranged a strip of paper which slowly moves past the opening of the selenium cell.

This paper is saturated with a solution of sugar of lead, and is contained in a gas-tight cylinder, as you observe. The motion to the paper band is imparted by clockwork. Through this gas-tight cylinder containing the saturated paper band gas from the outlet of the purifiers is made to flow in a continuous stream, and thus, when the particular purifier begins to foul—in other words, when sulphurous hydrogen is passing in the gas—the paper band in front of the selenium cell changes color, is darkened as you know. As this will obstruct the light from striking the selenium, the breaking of the current from the battery will cause the bell to ring, and we are thus informed that the purifier is faulty in operation (demonstration). *In this manner a chemical fouling of the gas is made to become audible to our ears.* With the aid of the selenium cell, in combination with a relay, I can now produce a number of effects by means of the indirect influence of rays of light; as, for instance, just now, when a bell was sounded; and we can have the electric current open and close the stopcock of a street lamp, etc.

I have here a so-called long distance igniter of a form with which no doubt you are all quite familiar. It is an "Auer" burner with auxiliary lighting flame, the stop-cock of which is operated by means of an electric contrivance fixed in the crown of the lamp. We now connect this incandescent burner with the dry battery and the selenium cell under the influence of a light, corresponding to daylight; in which condition the "Auer" (incandescent Welsbach) burner will not be lighted. But, as soon as it begins to get dark, or night, and the

selenium cell becomes darkened, the dry battery is shunted into operation, the gas cock will be opened and the lamp will be lighted (demonstration, see Fig. 587). Reversing the operation now, or representing

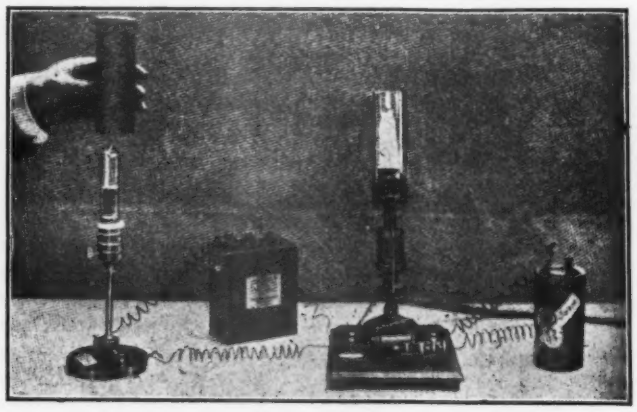

Fig. 587.

the coming on of daylight, as soon as the selenium cell is subject to light, the lamp will be automatically extinguished (demonstration). In street lamps of this sort, the selenium cell is placed over the top of the cover of the lantern, so that it may not be affected by the light rays of the lamp itself, else the lamp would be continuously lighted and extinguished (demonstration, see Fig. 587). These automatic lamp lighting apparatuses by means of the selenium cells possess decided advantages over those at present in use. There is no increase in pressure, clockwork or pneumatic piping required; instead of these, the coming on of night or darkness will cause the lamp to be lighted automatically, while the coming on of daylight will in like manner extinguish the lamp. To this may be added, that by means of setting of the relay, the operation can be still further, and as may be desired, kept under control. Outside of the lighting of street lamps, these selenium cells may be applied to the automatic lighting of gas buoys to great advantage.

Another application of this peculiar property of selenium may be to gas meters with two counter trains—one to record the gas passing during hours of daylight, the other that which passes during the night. Hitherto this work was accomplished at that class of apparatus which are sometimes known as "two tariff meters," by shunting in the opposite counters by means of clockwork, or else by drawing of a hand lever. Experiments are now being made to accomplish this work by means of a selenium cell, so that by nightfall or at daybreak this operation may be automatically and reliably brought about.

In conclusion, I desire to call attention to the Siemens selenium photometer. You see here (see Fig. 588) a metal funnel, at the bottom of

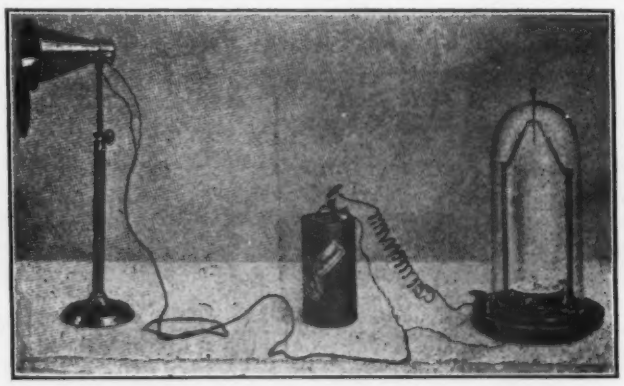

Fig. 588.

which there is a selenium cell, which is connected with a dry battery and galvanometer. The metal funnel with selenium cell is used in place of the slide box or sight box of an ordinary photometer. The operation of the selenium photometer is as follows: The funnel is at first turned to face the standard candle or lamp, and the deflection of the needle of the galvanometer is noted. Then the mouth of the funnel is turned to face the source of light which is to be measured and fnnnel and selenium cell are moved until the galvanometer needle will show the same degree of deflection as before. Figuring then in the usual manner the two distances mentioned above, the required illuminating power is found. While with the customary method of photometry results seldom would agree, by reason of the difference in eyes of operators, and for other reasons with which you are acquainted, and as because of these differences inaccuracies become easily possible, the selenium photometer is again brought to your attention, for by its use such differences cannot occur. The deflection of the galvanometer needle can be clearly read regardless of deficiencies in human eyes.

A selenium photometer of the latest construction for all-round illumination is herewith shown (see Fig. 589). With it there is the battery and battery tester in the galvanometer box.

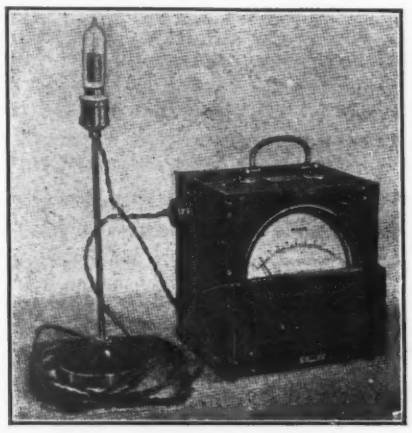

Fig. 589.

So far we have given a free translation to the excellent and valuable paper of Mr. H. Raupp. The translator herewith begs leave to call the attention of Messrs. W. E. Steinwedell and B. McAdam, joint editors of the Wrinkle Department of the coming American Gas Institute, to this subject especially, and these energetic young men may be able perhaps to give us an exhibition of the sort which Mr. H. Raupp gave his colleagues, and which we now leave to the reader to decide if it is not a subject worth while to take into serious consideration; though, after all, it may be a bit too much to be classified with mere "wrinkles," while a number of the same are certainly of great value to the practical gas man.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

INDEPENDENCE, MO., is to have natural gas at 25 cents per 1,000 feet. A special election held there resulted in granting a franchise to the Jackson County Heat, Light and Power Company to supply the natural gas at 25 cents, and 20 cents per 1,000 to manufacturers using 100,000 feet. Still heavier users are to get a still lower price. The company to receive the franchise is the same as is now serving Independence with artificial gas. A $5,000 forfeit has been deposited that the company will be supplying the town with natural gas within 9 months. That's right, get together.

JUSTICE GIEGERICH in the Supreme Court of New York, in the case of Dionegi Rebecchi, granted a writ of peremptory mandamus to compel the Consolidated Gas Company to furnish gas to the petitioner "at the statutory rate of 80 cents a 1,000 cubic feet. Rebecchi asserted that the Company refused to serve him at less than $1 a 1,000 feet and had threatened to cut off his supply of gas. The suit was in the nature of a test. After holding that a mandamus is the proper and legal remedy in such case, Justice Giegerich said, in part: "The principal contention on this point by the respondent Company is that the price of 80 cents a 1,000 cubic feet is insufficient to afford its stockholders a reasonable income on their property and that the statute is, therefore, unconstitutional and void in that it deprives them of their property without compensation or due process of law. As I construe its defense, the Company does not allege the 80-cent rate does not enable it to earn enough to cover cost of manufacture, distribution, reasonable allowance to offset depreciation and cost of changes of machinery, and also to make good the loss arising from the abandonment of portions of its plant and return a reasonable profit on a fair value of the property owned and used by it in business, but that such rate is not enough to cover the amounts just enumerated, together with a return on the original capitalization. I hold against the contention of the respondent that it is entitled to charge such rate as to pay in perpetuity a return on the original capitalization, which, so far as is alleged, may no longer be based upon either tangible or real value. Its stockholders are entitled to a reasonable profit on the actual value of the plant and property of the Company, but not on such value plus the amount of some former capitalization."

THE De Pere (Wis.) Electric Light and Power Company has asked the Council for a gas franchise in the city of De Pere, and if granted it will put up a plant for the purpose of supplying people of that city with gas for both lighting and fuel purposes.

THE Shawnee (Okla.) Gas and Electric Company, a new corporation capitalized at $500,000, and composed of the stockholders of the Shawnee Gas Light Company, owners of Shawnee's present $150,000 coal gas plant, has secured an ordinance from the Council authorizing the sale of the latter's plant to the new Company, and in turn the city extended the franchise for 21 years, by granting an entirely new franchise to the new Company. A check for $2,000, deposited when the former franchise was passed as a guarantee that the Company would erect its big plant and lay 20 miles of mains within a year, was ordered returned to the Company as it now has over 39 miles of mains in service. This Company has some big plans on foot and expects to make some important industrial announcements soon.

THE resignation of James T. Baker as Manager of the Aurora (Ills.) Department of the Western United Gas and Electric Company, as well as that of James K. Murdock as Manager of the Joliet Department, leaves two positions to be filled.

THE Shippensburg (Pa.) Gas and Electric Company is installing an entirely new plant for use in the borough.

MR. E. Wintemute, who was with the Vancouver (B. C.) Gas Company for a number of years, has been appointed Manager, Secretary and Treasurer of the Nanaimo Gas Company, vice Mr. William K. Leighton, who has resigned owing to illness.

THE Street Railway Company, of Rockland, Me., has turned gas into its new holder erected by the Kerr Murray Company, of Fort Wayne, Ind.

AT a meeting of the city council of Beatrice, Neb., Doctor Eaton, of Cleveland, O., was granted a franchise to operate a 16-candle power gas plant in Beatrice. The proposed plant is to cost $50,000, and after it has been operated for 2 years the city is to receive 3 per cent. of the gross earnings. Work will be started soon on the plant. The A. S. Maxwell Company, which is represented by St. Joseph parties, withdrew its application for a gas and electricity franchise.

THE DeKalb Fuel, Light and Power Company has filed articles of incorporation with the Secretary of State, in Indianapolis, Ind. The capital of the Company is $100,000 and the incorporators are John Ross McCulloch, O. N. Guldlin and Charles M. Printz, of Fort Wayne, Ind. Mr. McCulloch is Cashier of the Hamilton National Bank, Mr. Guldlin is President of the Western Gas Construction Co., and Mr. Printz is Mr. Guldlin's sales manager. Some time since the Wayne General Construction Company, composed of a number of local capitalists headed by George W. Beers, secured a franchise to furnish artificial gas at Auburn and Garrett, Ind., and the Company now formed is to take up the franchise, and the Western Gas Construction Company is to erect the necessary plants. The organization is merely temporary to enable the carrying out of the plans for furnishing gas to the two cities mentioned. The franchise calls for a rate of $1.20 per 1,000 cubic feet.

THE Peoria (Ills.) Gas and Electric Company gave away 500 children's bathing suits on the opening of the new public bathing house of that city.

AFTER a meeting of the New London (Conn.) Board of Trade Committee on a site for an industrial building in that city, Chairman Armstrong said that there was little to announce in the way of results except that the balance of favor seemed to rest on the old gas plant site. The Company needs more land, and not so valuable.

THE Rockford (Ills.) Gas Light and Coke Company will install a stack of benches this year, and other improvements are planned.

MR. C. E. STEVENS, of Haverhill, Mass., has been engaged as Superintendent of the gas plant of the Orange County Lighting Company, of Middletown, N. Y., to succeed W. J. Max. Mr. Stevens, who, for 17 years, has been the Superintendent of the Gas Company at Haverhill, entered upon his duties in Middletown, August 20.

IT is announced that the Peoples Gas and Coke Company, of Los Angeles, Cal., which has been operating in the business and central districts of that city during the past 3 years, has been organized, a number of Eastern and local capitalists having subscribed large sums of money to the enterprise. The capitalization, as indicated by the articles of incorporation, is $5,000,000. A number of San Diego and other Southern California men also are stockholders. A meeting will be held and officers elected soon. Professor Lowe, founder of the corporation, states that the building of a system throughout Los Angeles will begin next week. Much material has been purchased and more steel piping has been ordered from the East. In addition to the South Pasadena plant, the St. John street plant will be put into operation in making gas. The Company also will build another large gas plant near the city, in order to take care of the increased demand of the enlarged distributing system.

THE city of Buffalo, N. Y., is being supplied with water gas during the stokers' strike, and the city authorities are trying to compel the Company to return to coal gas, although the present supply is of superior quality to that heretofore furnished. Of course, it is plainly seen that these municipal authorities are what is ordinarily termed "sympathizers." However, Mr. W. S. Risely, the Manager, has taken a strong stand and has the situation well in hand.

WOODBURY, N. J., will have a gas plant.

LYONS, N. Y., is in the market for a bench of 6 retorts.

THE Board of Public Improvements at St. Louis, Mo., has suggested municipal electric and gas plants if better prices cannot be obtained from the present companies. The price of gas lamps is now $22 per year.

THE Massachusetts Commissioners have authorized the Lawrence Gas Company to issue 4,000 additional shares of stock at $120 each.

THE Peoples Light Company, of Wilkesbarre, Pa., will instal a water gas set and other apparatus this year.

THE Managers and Superintendents of the United Gas and Electric Company of 40 Wall street, New York city, had their annual meeting in that city, Wednesday, Thursday and Friday, August 22, 23 and 24.

SEVERAL professional and business men have organized a corporation to be known as the Peoples Gas Light and Fuel Company of Bridgeton, N. J. Its purpose is to establish a second gas plant there. The capital stock has been fixed at $70,000, with shares at a par value of $50.

THE Riverside (Cal.) Gas Company will reduce the price of gas from $1.35 per 1,000 to $1, providing they get 200 more consumers. This is good business.

MR. H. C. WHITEHEAD, of Richmond, was the successful bidder for the Richmond (Va.) gas works tar at $1.375 per barrel.

S. H. URY, of San Leandro, Cal., has invented an automatic closing gas cock. He says that countrymen can now safely blow out the lights.

THE Union Railway Supply Company, of Philadelphia, has purchased the Vineland (N. J.) gas plant. It is reported that the gas works of Glassboro, Pitman, Clayton and Vineland will be placed under one management, with one of the towns a producing center and the others to be supplied by pipe line.

H. M. WALLACE and Senator H. Fyfe are ready to build the Stoughton (Wis.) gas plant, for which they have received the franchise.

AT Torrington, Conn., the Gas Company is working up business by persuading the churches to light up their handsome memorial windows. This is a new idea and should succeed well.

THE Michigan Stove Company, of Detroit, has appointed Mr. Charles C. Schiller its New England agent.

THE J. W. Leonard natural gas franchise was granted at Springfield, Ills., but the conditions are so onerous that his backers have had to refuse to accept the grant, as no money could be raised for the project under the conditions imposed.

THE annual report of the Lancaster (Pa.) Railway and Light Company has been issued. The employees' wages were voluntarily raised, and it is announced that gas will be reduced from $1.50 to $1 per 1,000 feet.

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NOTIFICATION RESPECTING ADVERTISING.

Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:

New York—American News Co., 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, AUGUST 27, 1906.

The Market for Gas Securities.

While the general market has been very active, with wide fluctuation, gas stocks have been very dull and selling within very narrow limits, and will probably remain in this condition until the investigation of the companies is ended.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

AUGUST 27.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	141	141½x
Central Union Gas Co.—				
1st 5 s, due 1972, J & J	3,000,000	1,000	101	104
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S.	1,000,000	1,000	..	105
Mutual	3,500,000	100	225	250
New Amsterdam Gas Co.—				
1st Con. 5 s, due 1948, J. & J.	11,000,000	1,000	100	103
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	37	43
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	..	98	104
Northern Union—				
1st 5's, due 1927, J. & J	1,250,000	1,000	101	103
New York and East River—				
1st 5 s, due 1941, J. & J	3,500,000	1,000	108	111
Con. 5's, due 1945, J. & J.	1,500,000	..	104	110
Standard	5,000,000	100	140	160
Preferred	5,000,000	100	155	175
1st Mtg. 5's due 1930, M. & N.	1,500,000	1,000	104	108
The Brooklyn Union	15,000,000	1,000	110	130
1st Con. 5's, due 1948, M. & N.	15,000,000		107	..
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Bay State	50,000,000	50	5/16	¾
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	..	65
" 1st Mtg. 5's	509,000	1,000	95	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	9	10
" " Bonds, 5's	5,250,000	1,000	75	80
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	106¾
Cincinnati Gas and Electric Co.	29,500,000	100	103½	103¾
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	90	..
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	..	95
Preferred	3,026,500	100	107½	108
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	..	90
Mortgage, 6's	3,500,000	..	..	118
Chesapeke, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N. J.	1,000,000	100	15	17
Con. Mtg. 5's	850,000	1,000	92	95
Bonds	75,000	..	..	100
Detroit City Gas Co	5,000,000	50	..	50
" Prior Lien 5's	4,618,000	1,000	..	98
Detroit Gas Co., 5's	381,000	1,000	75	80
" Inc. 5's	15,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	..	110	112
" Bonds, 5's	10,500,000	..	107½	108¼
Indianapolis	2,000,000	..	60	70
" Bonds, 5's	2,650,000	..	104½	105
Jackson Gas Co	250,000	50	82	..
" 1st Mtg. 5's	290,000	1,000	97	100
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	..	105
Preferred	2,500,000	100	95	110
Bonds	10,000,000	1,000	104	104¼
Lafayette Gas Co., Ind	1,000,000	100	..	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	143	145
Madison Gas & Elec. Co.				
" 1st Mtg. 6's	350,000	1,000	106	108¾
" 6 per cent. scrip, due 1910	100,000	25	85	87
Massachusetts Gas Companies of Boston	25,000,000	100	59½	59¼
Preferred	25,000,000	100	89	89½
Montreal, Canada	2,000,000	100	218	218¾
Nashville Gas Lt. Co	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 6's	6,000,000	..	137	138
New Haven	2,000,000	25	200	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	91	91½
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	..
Rochester Gas & Elec. Co	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	104½	105¼
San Francisco, Cal	15,800,000	100	..	..
St. Joseph Gas Co. 1st Mtg. 5's	751,000	1,000	92	..
St. Paul Gas Light Co	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112¾	115
General Mortgage, 5's	2,465,000	1,000	96¾	..
Syracuse, N. Y.	1,975,000	100	50	55
Bonds	2,047 000	1,000	102	..
Washington, D. C	2,500,000	20	295	300
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	..	..	..
Wilmington, Del	600,000	50	230	..

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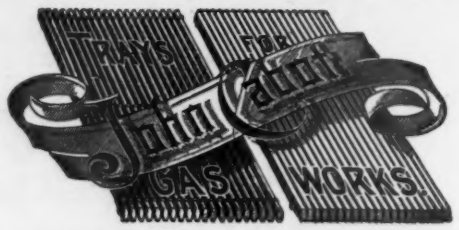

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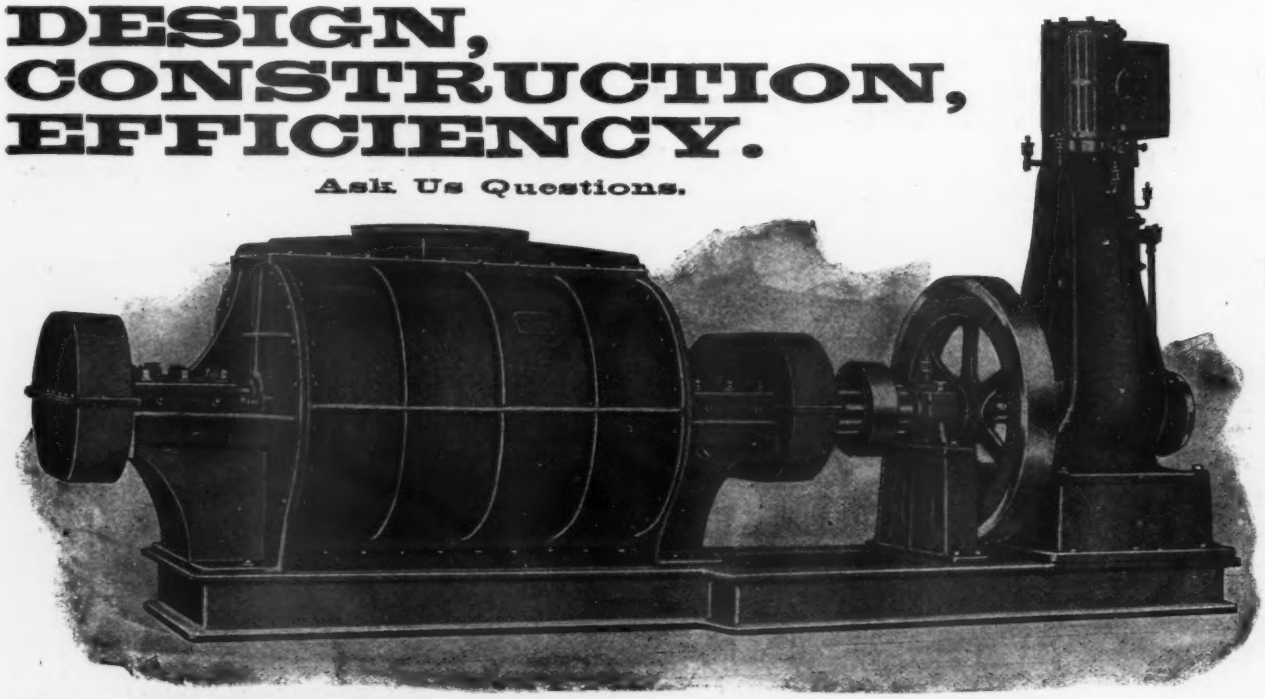

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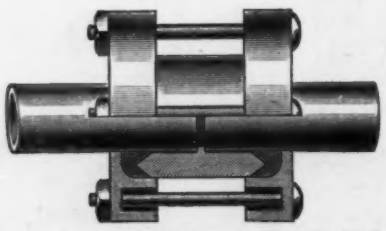
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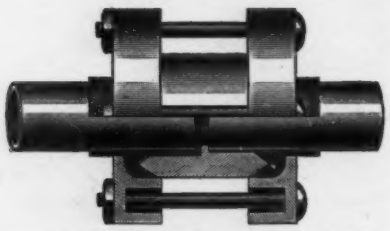
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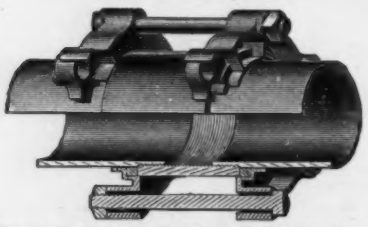
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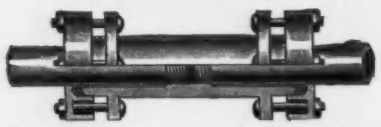
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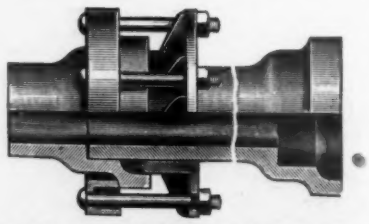
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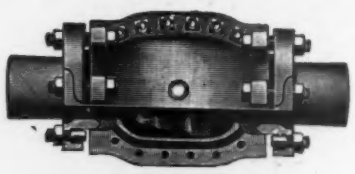
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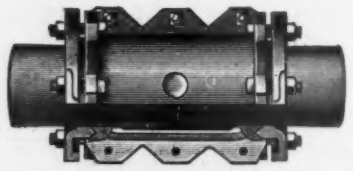
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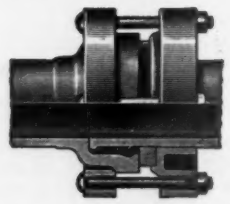
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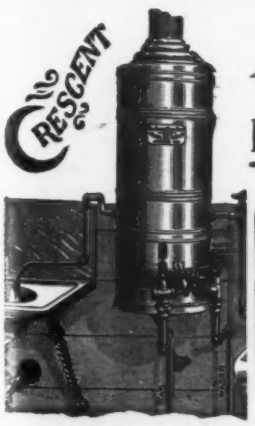

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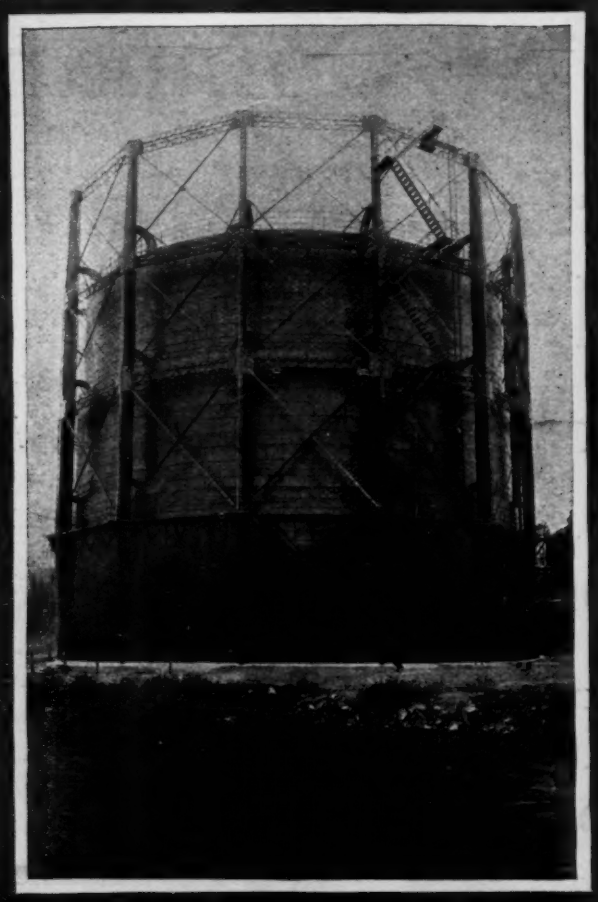

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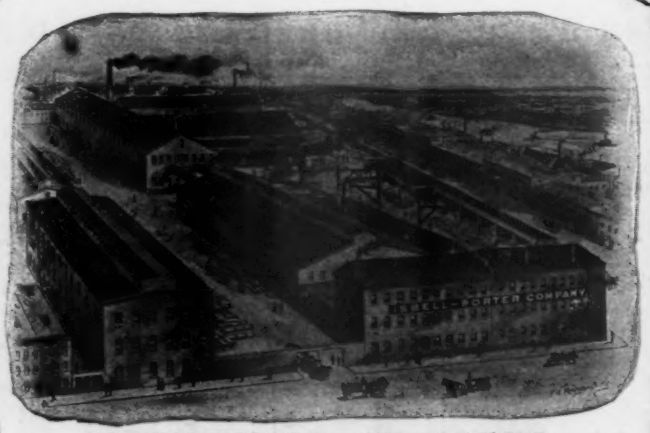

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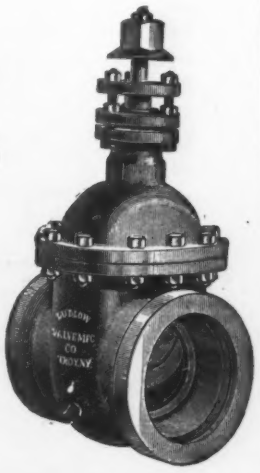

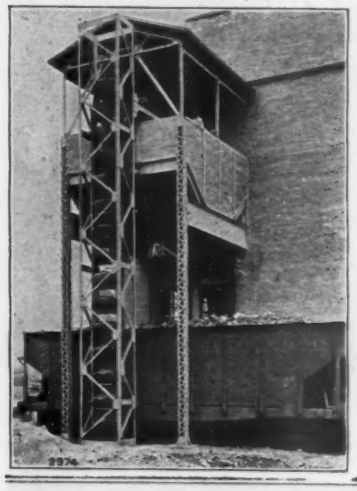

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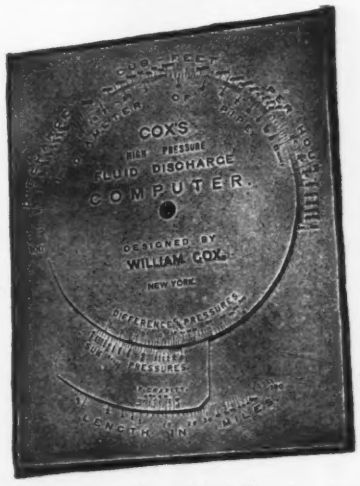

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p_1 = absolute initial pressure in pounds per square inch,

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w = specific gravity of the fluid when air = 1.

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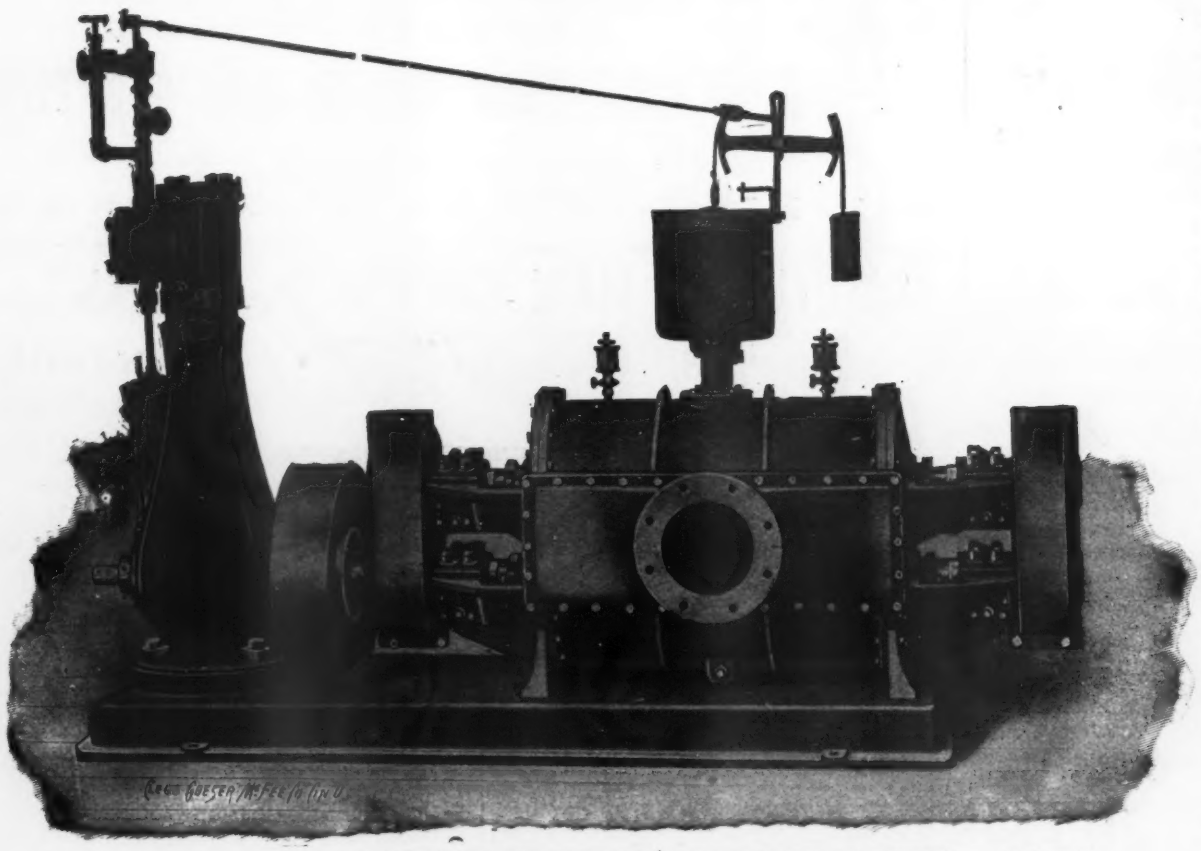

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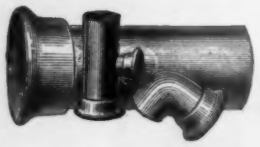

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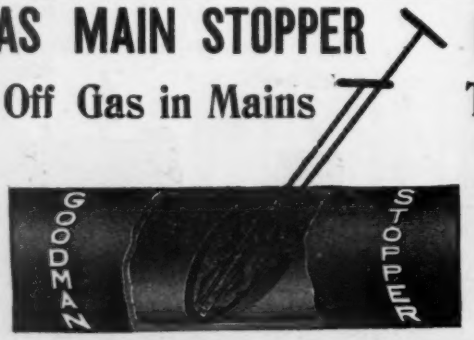

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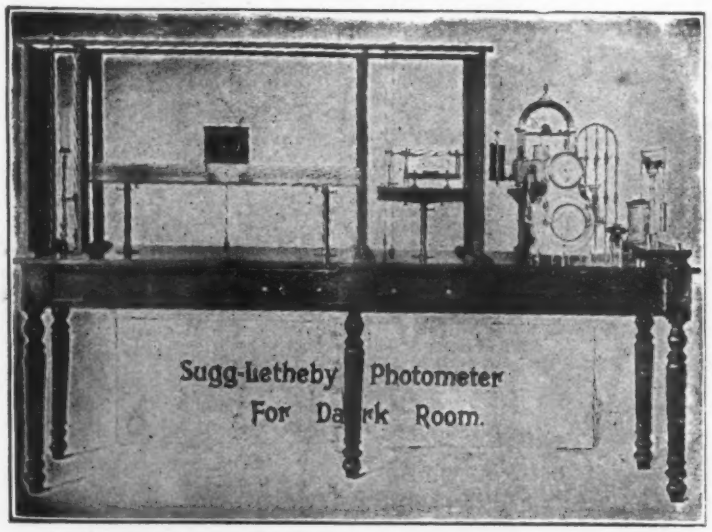
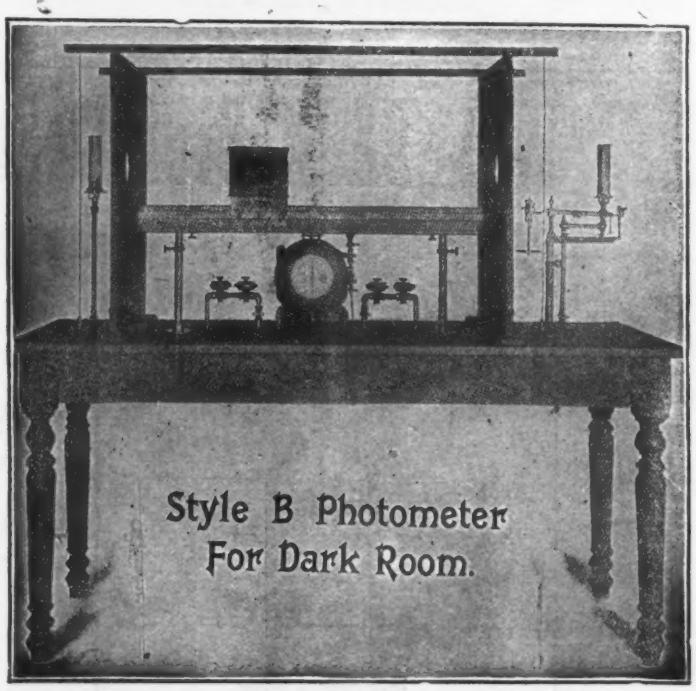
Sat.	1	No L.	No L.
Sun.	2	No L. FM	No L.
Mon.	3	No L.	No L.
Tue.	4	7.00 PM	8.40 PM
Wed.	5	7.00	9.10
Thu.	6	7.00	9.40
Fri.	7	7.00	10.10
Sat.	8	7.00	10.40
Sun.	9	6.50	11.10
Mon.	10	6.50 LQ	11.50
Tue.	11	6.50	12.40 AM
Wed.	12	6.50	1.30
Thu.	13	6.50	2.20
Fri.	14	6.50	3.20
Sat.	15	6.50	4.40
Sun,	16	6.30	4.40
Mon.	17	6.30	4.40
Tue.	18	6.30 NM	4.40
Wed.	19	6.30	4.40
Thu.	20	6.30	4.40
Fri.	21	6.30	4.40
Sat.	22	6.30	4.40
Sun,	23	8.40	4.50
Mon.	24	9.30 FQ	4.50
Tue.	25	10.30	4.50
Wed.	26	11.30	4.50
Thu.	27	12.30 AM	4.50
Fri.	28	1.40	4.50
Sat.	29	2 40	4.50
Sun,	30	3.50	4.50

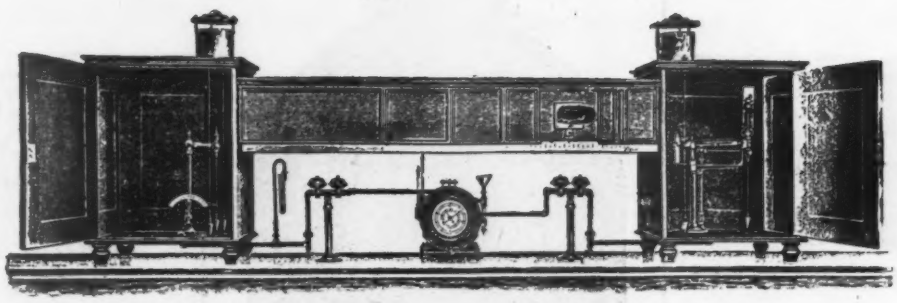
TOTAL HOURS DURING 1906.

By Table No. 1.

	Hrs.Min.
January	223.40
February	190.40
March	192.10
April	167.00
May	152.20
June	142.10
July	150.20
August	157.40
September	170.00
October	185.10
November	201.40
December	214.00
Total, yr.	2146.50







Closed Photometer For Light Room.

CIRCULARS SENT ON REQUEST.

PUBLIC LIGHTING TABLE.

SEPTEMBER, 1906.

Day of Week.	Date.	Table No. 2. NEW YORK CITY. All Night Lighting. Light	Extinguish.
		P. M.	A.M.
Sat.	1	6.30	4.20
Sun.	2	6.30	4.20
Mon.	3	6.15	4.30
Tue.	4	6.15	4.30
Wed.	5	6.15	4.20
Thu.	6	6.15	4.30
Fri.	7	6.15	4.30
Sat.	8	6.15	4.30
Sun.	9	6.15	4.30
Mon.	10	6.05	4.40
Tue.	11	6.05	4.40
Wed.	12	6.05	4.40
Thu.	13	6.05	4.40
Fri.	14	6.05	4.40
Sat.	15	6.05	4.40
Sun.	16	6.05	4.40
Mon.	17	5.55	4.50
Tue.	18	5.55	4.50
Wed.	19	5.55	4.50
Thu.	20	5.55	4.50
Fri.	21	5.55	4.50
Sat.	22	5.55	4.50
Sun.	23	5.55	4.50
Mon.	24	5.40	5.00
Tue.	25	5.40	5.00
Wed.	26	5.40	5.00
Thu.	27	5.40	5.00
Fri.	28	5.40	5.00
Sat.	29	5.40	5.00
Sun.	30	5.40	5.00

TOTAL HOURS DURING 1906.

By Table No. 2.

	Hrs.Min.
January	423.20
February	355.25
March	355.35
April	298.50
May	264.50
June	234.25
July	243.45
August	280.25
September	321.15
October	374.30
November	401.40
December	433.45
Total, yr.	3987.45

NEW YORK, 318 West 42d Street.
BOSTON, 820 Beacon Building.
PHILADELPHIA, Broad and Arch Streets.
ST. LOUIS, 712 Roe Building.
CHICAGO, 218 La Salle Street.
SAN FRANCISCO, 512 Oak Street.

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....OF AMERICA....

Controls and Operates the **Welsbach System of Street Lighting,**

Which includes its specially DESIGNED and PATENTED BURNER for PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 180 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

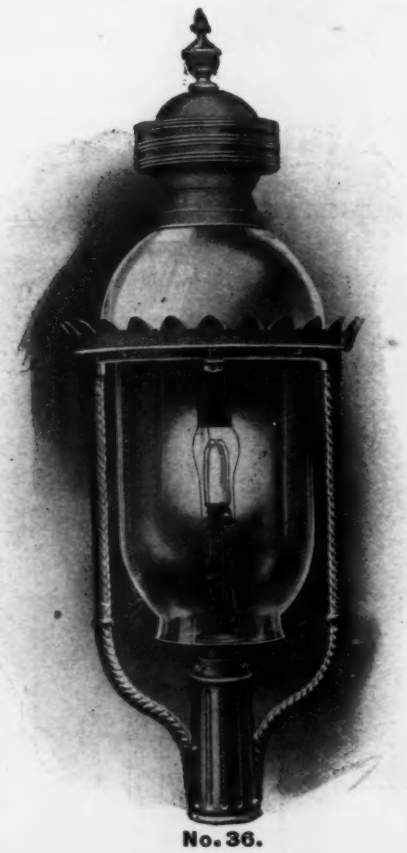
POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others interested in Municipal and Outside Lighting.



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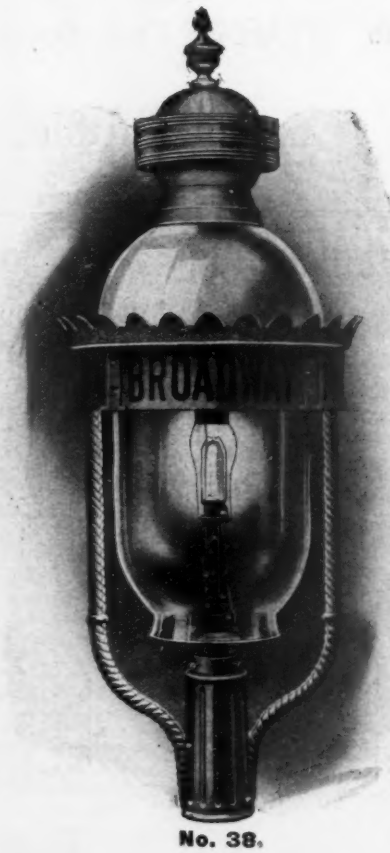

No. 38.

THE NEW NO. 7 WELSBACH DINING ROOM FIXTURE.

PRICE, EACH, COMPLETE, WITH SHADE, FRINGE, MANTLE AND CHIMNEY, $14. PER DOZ., $150. DISCOUNT, 50 PER CT.

Standard Length, 30 inches.
The New No. 7 Welsbach Dining Room Fixture, when ordered, will be sent complete, as follows:

- 1 No. 7 Harp Fixture and Brass Crown finished in Brushed Brass.
- 1 No. 66 Welsbach Burner (high candle power).
- 1 No. 4 Pilot By-pass.
- 1 No. 4197 Mantle — Intensive Brand.
- 1 No. 306 Chimney (air hole).
- 1 Fourteen-inch GREEN Art Glass Shade, with six-inch Green Beaded Fringe.

VARIATIONS.

Finished in oxidized copper, oxidized brass, etc., 25 cents extra.

Shades in Ruby and Green--Ruby, Amber and other colors, without extra charge.

Special colors require a few days extra time to fill orders.

Green Shades will be shipped unless otherwise ordered.

This fixture is being largely used by Gas Companies as a dining room fixture at the popular retail price of $10 complete, and is a great favorite for moderate sized two and three-story residences. In popularity and price it is unequalled.

WELSBACH CO.,
Salesrooms in All the Principal Cities of the United States.
Factories:
GLOUCESTER, N. J.
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THE UNITED GAS IMPROVEMENT COMPANY

For the Six Months Ending July 1st, 1906, has been Awarded Contracts for 25 Sets of

Standard Double-Superheater Lowe Water Gas Apparatus.

PARTIAL LIST OF PLACES:

New Britain, Conn. (2d contract).	**Philadelphia, Pa.**	**Lewiston, Pa.**
Malden, Mass. (3d contract).	**Waterbury, Conn.**	**Greenville, Tex.**
Kirksville, Mo.	**Manchester, N. H.**	**New York,** Cent. Un. (3d contract).
St. Johnsbury, Vt.	**Allentown, Pa.**	**Jefferson City, Mo.**
Memphis, Tenn. (2d contract).	**Omaha, Neb.**	**Peekskill, N. Y.** (2d contract).
Council Bluffs, Ia. (2d contract).	**Muskegon, Mich.**	**Waterville, Me.**
Seattle, Wash. (2d contract).	**Nazareth, Pa.** (2d contract).	**Washington, D. C.** (3d contract).

TOTAL SETS TO JULY 1, 1906, - - - - - 618

TOTAL DAILY CAPACITY TO JULY 1, 1906, 488,930,000 CUBIC FEET.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

Established 1858. Incorporated 1890.
CHAS. E. GREGORY, Prest. DAVID R. DALY, V.-Prest. & Treas.
H. D. ABERNETHY, Sec.

J. H. Gautier & Co.

Greene & Essex Streets,
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FIRE BRICK and FIRE CLAY SPECIALTIES.

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

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SPECIAL HIGH GRADE REFRACTORY MATERIAL FOR BENCH SETTINGS AND WATER GAS LININGS,

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CHRISTY SETTINGS.

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Manhattan Fire Brick and Enameled Fire Clay Retort Works.

Works at Weber, on the Raritan River, Middlesex County, New Jersey.

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Modern Coal Gas Benches,

With either Horizontal or Vertical Retorts, Half-Depth and Full-Depth Recuperative Furnaces.

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STANDARD BENCH IRONWORK.

Linings for Water Gas Apparatus, High Grade Fire Brick of All Shapes and Sizes, Ground Fire Clay, Ground Fire Brick in Bulk or in Barrels.

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Works.
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All styles of which we have in operation, equipped with the BEST of LATEST IMPROVEMENTS, proving our claim for SUPERIOR QUALITY and EFFICIENCY.

INCLINES—We have in SUCCESSFUL OPERATION benches of Inclined Retorts, MANUFACTURED and ERECTED by us.

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A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

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An Analysis of the Principal Gas Undertakings in England, Scotland and Ireland. Being the 37th year of publication. Compiled and arranged by JOHN W. FIELD, Sec'y and Gen. Mgr. of The Gas Light and Coke Company, London. Price, $5. For Sale by
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We are the **Exclusive Agents** *for the* **Mitchell Patent Benches,** *Constructed with Half or Full Depth Furnaces, to Burn either Coal or Coke, and Arranged for Front or* **Rear Clinkering.** *The* **Mitchell** *is the* **Original Coal Firing Bench.** *We also Erect Plain Benches with* **One** *to* **Six Retorts.**

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Bronder Patent Stoking Machinery.

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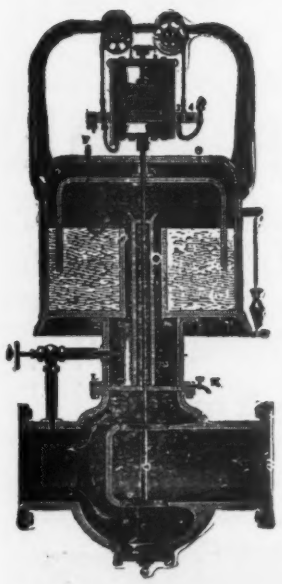

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Half and Full Depth Benches of Our Own Design, Containing 6, 8 or 9 Retorts.

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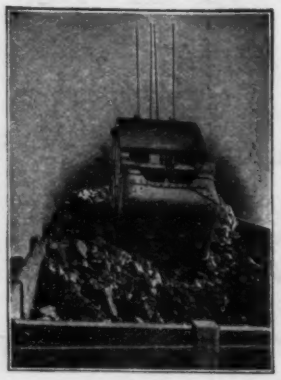

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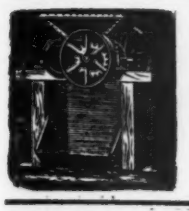

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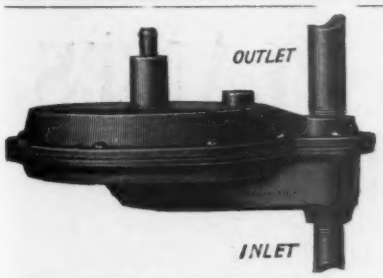

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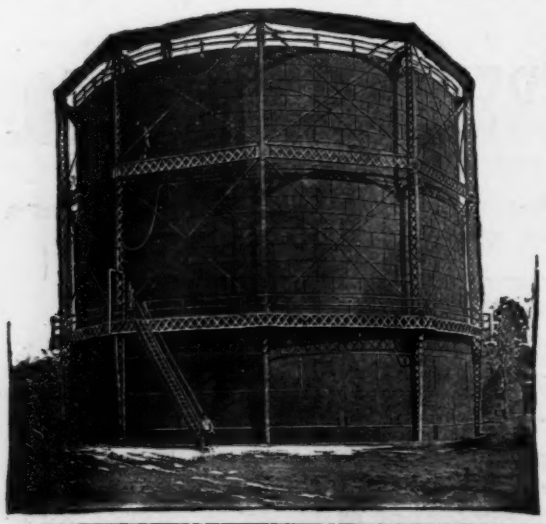

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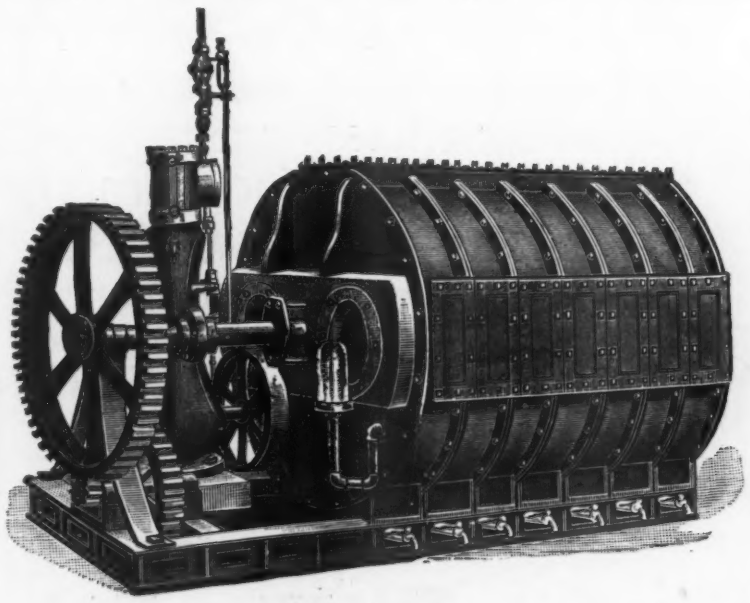

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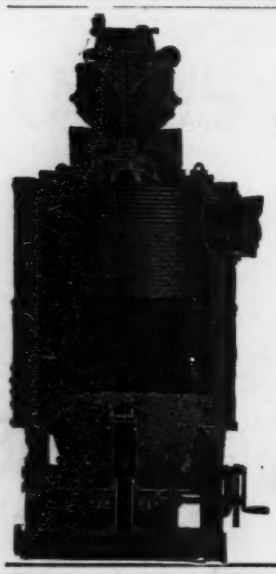

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LOWE CRUDE OIL WATER GAS is made exclusively from oil, no solid fuel, such as coal or coke, being used. In localities where oil can be procured at a sufficiently low figure to warrant the use of this gas making method, the results will be ideal, the gas giving a smooth, clear and brilliant light. As ordinarily made it is from 20 to 22-candle power and from 650 to 700 B.T.U. per cubic foot, and about 95 per cent. combustible, no air entering into its composition. The absolute minimum of labor is required, there being no solid fuels to handle. Many plants in units of daily capacities ranging from Sixty Thousand to Four Million cubic feet are in operation. Full information upon request.

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Diameter of flanges.....	13 inches.	16 inches.	18 inches	22¼ inches.	27 inches.	3 inches.	37½ inches	44 inches.
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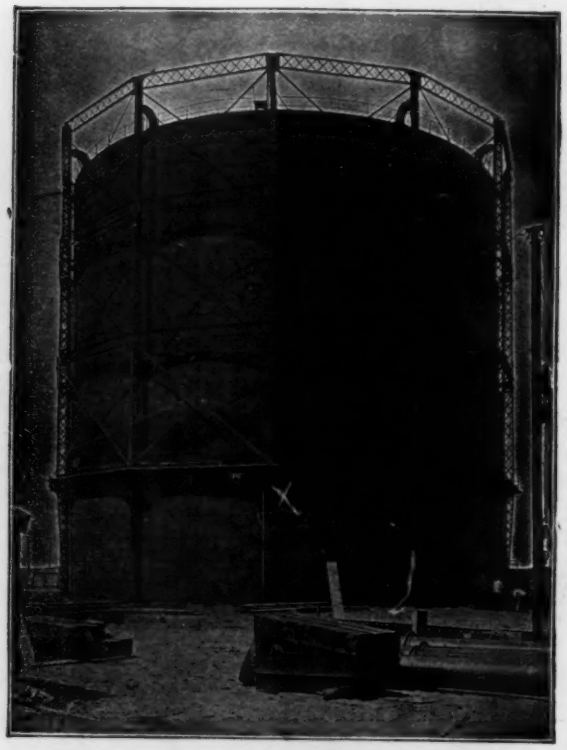

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This Computer solves the following formula, which is applicable to Gas, Air and other elastic fluids, flowing through long pipes with high initial pressures:

$$\text{Discharge in cubic feet per hour at atmospheric pressure} = 33.3\sqrt{\frac{d^5 \times (p_1^2 - p_2^2)}{L \times w}}$$

Where d = diameter of pipe in inches,
p_1 = absolute initial pressure in pounds per square inch,
p_2 = absolute terminal pressure in pounds per square inch,
L = length of pipe in miles,
w = specific gravity of the fluid when air = 1.

To Find the Discharge from a Pipe and the Required Size of Pipe.

(1.) Set the specific gravity of the fluid opposite the length of pipe;
(2.) Bring the DIFFERENCE of the initial and terminal gauge pressures opposite the SUM of the initial and terminal gauge pressures;
(3.) Opposite any diameter of pipe will now be found the discharge in cubic feet per hour at atmospheric pressure; and
(4.) Opposite any desired discharge will also be found the required diameter of pipe.

Price of the Computers, in Cloth Case, 6½ x 8 inches, $5 Each, Net.

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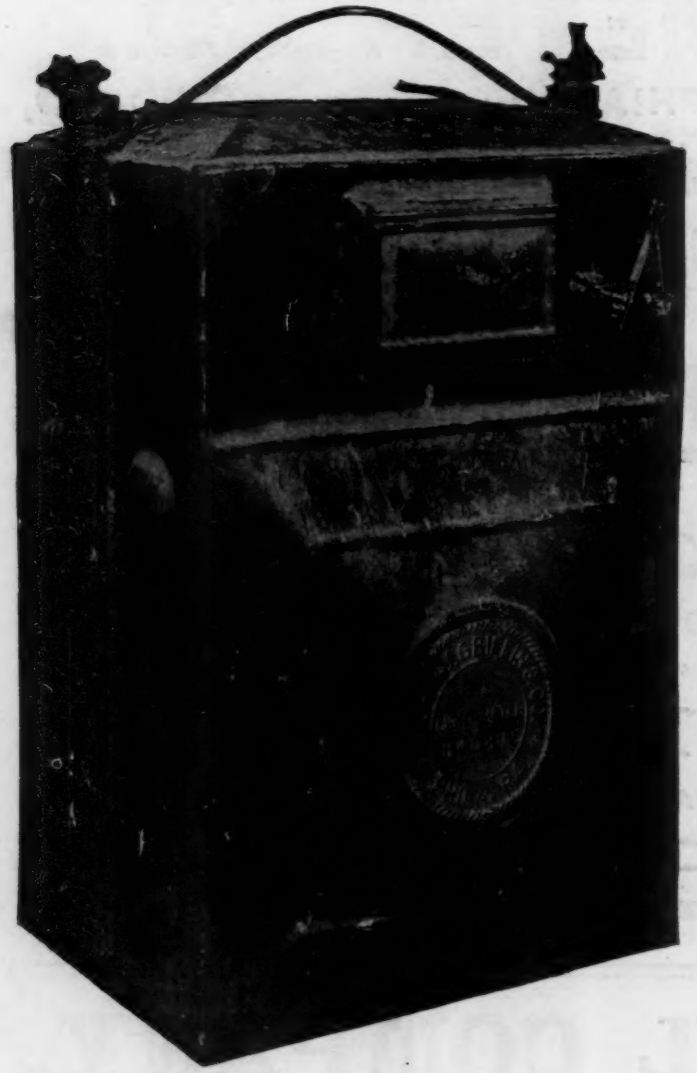

This is a photograph of a 3-light regular meter out of a lot of meters received from the Coatesville Gas Co., Coatesville, Pa., to be repaired and converted into prepayment meters.

AFTER.

This is the same meter after it has been repaired and converted into a new prepayment meter.

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